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COMMITTEE PRINT NO. 6

GREATER YELLOWSTONE ECOSYSTEM

AN ANALYSIS OF DATA SUBMITTED BY FEDERAL AND STATE AGENCIES

PREPARED BY THE

CONGRESSIONAL RESEARCH SERVICE
LIBRARY OF CONGRESS

FOR THE

SUBCOMMITTEE ON PUBLIC LANDS

AND THE

SUBCOMMITTEE ON NATIONAL PARKS AND RECREATION

OF THE

COMMITTEE ON
INTERIOR AND INSULAR AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

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COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515

December 22, 1986

MEMORANDUM

TO: All Members of the Committee

FROM: Morris K. Udall, Chairman

SUBJECT: Letter of transmittal

This is to transmit to the Members of the Committee on Interior and Insular Affairs an analysis of Federal and State land management data on the Greater Yellowstone Ecosystem which was prepared for the use of this Committee by the Congressional Research Service of the Library of Congress.

Also enclosed is a letter from Chairman Seiberling of the Public Lands Subcommittee and Chairman Vento of the National Parks and Recreation Subcommittee, along with their "Summary and Observations" which provide you with their interpretation of information provided in the CRS analysis. In addition, Reps. Seiberling and Vento suggest areas mentioned in the report where the Committee might focus some of its attention in the future.

Enclosures

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515

December 9, 1986

Honorable Morris K. Udall
Chairman
Committee on Interior
and Insular Affairs
U.S. House of Representatives
1324 Longworth House Office Building
Washington, D.C. 20215

Dear Mr. Chairman:

We are pleased to transmit for the thoughtful consideration of the Committee an excellent analysis of Federal and State land management data on the Greater Yellowstone Ecosystem as prepared by the Congressional Research Service (CRS) of the Library of Congress.

We have also included our own "Summary and Observations," interpreting certain of the data and suggesting areas where the Committee and the Congress might concentrate future oversight and legislative efforts.

The Greater Yellowstone Ecosystem is a very large area sprawling across the boundaries of Wyoming, Montana and Idaho atop the Continental Divide. Its acreage, estimated to be as high as 14 million, is managed by a myriad of agencies, mostly Federal. The fragmented management pattern makes difficult decision-making in an area replete with virtually all the classic natural resource development conflicts in the West--and in a setting deemed very special by Americans.

We held a joint Subcommittee hearing on October 25, 1985, to determine the facts but were dismayed at the relative lack of information on the area. We subsequently asked the managing agencies for virtually all the data they had, forwarded the materials to the Congressional Research Service for analysis, and ultimately received the Report that is attached. The details and chronology of the collection procedure are explained more fully in our "Summary and Observations."

The Report makes an important contribution to Congressional and public knowledge on the Ecosystem. It marks the first attempt to assemble in one document statistics that heretofore have been available only in separate agency files. In that sense, it represents "new" information and should be helpful in all efforts to resolve Ecosystem problems.

The Subcommittees wish to thank CRS professional staffers Dr. M. Lynne Corn, ecologist, and Dr. Ross Gorte, forest economist, as well as their Section Chief, Susan Abbasi, and other Library of Congress personnel who spent months processing an enormous amount of raw data into understandable form. The final Report, properly non-partisan in the CRS tradition, is a valuable addition to the public record now building on the Greater Yellowstone Ecosystem.

Special appreciation is also due Dr. Kathryn A. Saterson, Congressional Science Fellow sponsored by the American Institute of Biological Sciences and the American Society for Plant Physiology, who worked during most of this period for the Subcommittee on Public Lands. While she does not share formal authorship of the document, the record should note her very substantial contribution to the analysis of data and drafts of the chapters dealing with physical features, water developments, and energy and minerals management.

Sincerely,

JOHN F. SEIBERLING
Chairman, Subcommittee
on Public Lands

BRUCE F. VENTO
Chairman, Subcommittee
on National Parks
and Recreation

Attachment

SUMMARY AND OBSERVATIONS

Background:

When the Subcommittee on Public Lands and the Subcommittee on National Parks and Recreation announced an October 25, 1985 joint hearing on Federal land management practices on the so-called "Greater Yellowstone Ecosystem," a more or less routine handling of a complex issue was expected. However, as the rest of this publication will attest, the hearing was only the prelude to a larger effort to learn more about that important area.

The hearing was a long one. Thirty-eight witnesses, representing as many organizations and government entities, testified well into the evening. There was general agreement on the area's importance. Otherwise, testimony ran the full gamut. The diversity of views offered was matched by the varied land management policies and techniques of the Federal agencies which, proceeding under thin mantles of inter-agency cooperation, make thousands of separate decisions whose cumulative impacts really define the overall handling of the area.

It was the inability of the Subcommittees to focus the debate that led to the call for more information. With four Federal agencies, three States, and private owners all making land management decisions affecting seven national forests, two national parks, three wildlife refuges, wilderness and grazing areas, State, county and private lands, and more, the lack of common data and consensus was understandable. Nevertheless, it was dismaying.

Reasoning that the conflicts inherent in managing the Greater Yellowstone area will simply grow more acute, and that many will still come back to the Congress for resolution, the Subcommittees sought to find out "what is known" about the area under discussion.

The first step was to define the "Ecosystem's" boundary. The Congressional Research Service (CRS) of the Library of Congress was asked to analyze all of the testimony, identify "areas of concern" to the witnesses and draw a boundary around those areas. The

map was duly completed, with the limits drawn whenever feasible along already existing administrative lines (e.g., county lines, National Forest District lines, etc.). The Subcommittees chose not to label it an "ecosystem" map because of the continuing evolution of the definition of that word. However, it was clear from the testimony that the boundary enclosed essentially a free-standing area of great size in which the movement, interdependence and interplay of biota resemble the classical definition of an ecosystem. Moreover, even opponents of the term had begun, for convenience sake, to refer to the "Greater Yellowstone Ecosystem." Thus the term (or simply "Ecosystem") will be used throughout these introductory comments.

With the map in hand, the Subcommittees then prepared a thorough set of questions for the land managing agencies responsible for the area, principally the U.S. Forest Service, the National Park Service, the U.S. Fish and Wildlife Service, the Bureau of Land Management and the fish and wildlife agencies of the States of Montana, Wyoming and Idaho, and other Federal agencies as well. They were asked to tell us "what is known" in areas ranging from visitor use and timber sales to locations of abandoned mines and grizzly bear kills. Knowing the amount of work this would entail for each agency, the Subcommittees stipulated that no new data should be compiled. Either the information existed and could be transmitted or a gap existed. In the latter case, the agency was asked to state that the data was unavailable.

Voluminous data and hundreds of maps arrived and were referred to the Congressional Research Service for independent analysis. The U.S. Geological Survey and the Forest Service were especially diligent in submitting quality data by the deadline and continuing to provide attentive cooperation as the analysis continued.

CRS staff performed professionally in transforming the often disjointed raw data into an intelligible format. Theirs was an especially difficult task. As is pointed out in the Report, while Federal agencies created no new data for submission, the fact that so much existing data on

that huge area had never before been compiled into a single document means that "new information," in a sense, is being offered. Likewise, the authors point out that the maps accompanying the report are unique in the information that they convey.

The Report does not purport to cover every item of information submitted by the agencies. In some cases, the data was too scarce or ambiguous to be analyzed. At the other extreme, the data on the qualifications of Federal personnel working in the areas was so voluminous that CRS resources were not sufficient to computerize it. This and other agency submissions being public information, it may remain for enterprising graduate students to review the materials for potential dissertation topics. Information not used in the report remains available for future public and Congressional access (for Library of Congress accession, contact the Geography and Map Division for "Yellowstone: Ecosystem, Resources and Management Inventory Maps, #G4262.Y4G3 svar .Y4").

In any event, the choice of what information to highlight and how to highlight it remained for the Congressional Research Service. The Report stands on its own. The following comments represent our reactions to the Report. Certain generic (and occasional specific) observations are suggested by the data amassed and they are offered in the following paragraphs.

Observations:

The first thing likely to strike the reader of the CRS Report is the unevenness of the cumulative data on the region, both in quantity and quality. One realizes that each agency has its own special set of needs as well as constraints when it comes to collecting information. But there is also a need to look at the "big picture," and that has proved exceedingly difficult to do. It is precisely the inability to do so that has permitted some of the major ecosystem problems to build until today they seem nearly intractable. It is imperative that all persons working to resolve conflicts in that region agree, at the very least, on statistics and definitions so that, hopefully, they may agree ultimately on the solutions.

The complexity of the Greater Yellowstone Ecosystem is suggested by its sheer size. The map prepared by the Congressional Research Service indicates that it may contain up to 14 million acres. Clearly the centerpiece is Yellowstone National Park, also the center stone in the "crown jewels" of America's protected areas. This 2.2-million-acre preserve has excited the imagination not only of most Americans for over a century, but has been a drawing card for large numbers of foreigners as well. So important is its stature that it has been designated a World Biosphere Reserve by UNESCO and inscribed on the World Heritage List under the World Heritage Convention. It contains unsurpassed natural beauty, including waterfalls, lakes, mountains and the most spectacular geysers in the world. Yellowstone is also famous for its splendid diversity of wildlife--elk, deer, moose, bald eagles, trumpeter swans, trout and grizzly bear.

However, the focus of the joint hearing, and of the attached Report, rightfully has extended beyond the Park as well to the several million acres of surrounding territory. These areas contribute directly and indirectly to the health of natural systems in Yellowstone Park. They also possess their own unique values and have their own human and animal constituencies. More than 90 per cent of the lands surrounding Yellowstone are Federally owned and managed. As a measure of public concern over the non-Park lands, a majority of persons testifying at the hearing directed their remarks at these other parts of the Ecosystem.

The Greater Yellowstone Ecosystem contains most of the animal species which were present before the arrival of the first white visitors. The wolf is the only one of the original major vertebrates still missing from the area. Nevertheless, the populations of many animal species have been reduced by human activities in or near their habitats, and further reductions are likely. Of critical concern is protection of the water quality of streams and lakes of the area as well as the associated riparian areas. Cutthroat trout, being a food source for many species and an indicator of water quality, are an especially important linchpin in the system.

In the public's mind, grizzly bears are the most important indicator of the Ecosystem's health. These large animals, whose most heavily used habitat is often crucial to many other species, are particularly sensitive to human presence and are thus the first species displaced by development activities. Although expressly protected by Federal law, testimony at the hearing charged the agencies with lax enforcement. Deaths do continue, most of them seemingly clustered in discreet areas. The Report uses the term "black hole" in connection with the cluster areas. The term is particularly descriptive because history shows that where grizzlies come into conflict with human activities, the animals invariably lose, very often with their lives.

There are many human activities in the Greater Yellowstone Ecosystem. The principal ones involve timber harvesting, water developments, grazing, energy and mineral exploration and development, and recreation. Phosphate mining, 100 miles south of Yellowstone Park, is the single largest industry on Federal lands in the region. However, the Report shows that recreation is the major economic activity overall, supporting two-thirds of the direct jobs resulting from activities in the National Forests. This is a significant statistic that may not be generally understood. Report data suggests that the economic values assigned by the Forest Service to recreation seriously misrepresent its importance to local communities and hence masks recreation losses associated with other human activities.

By any measurement, the submitted data on human activities is inadequate for comparing the effects of various management options. The agencies may be able to make a convincing case on a particular project, but as a general rule, that would not be apparent from the information offered to the Subcommittees. The data on recreational activities appear to be particularly deficient for understanding what, when and where the various activities are occurring; Forest Service categories for recreation are, frankly, mystifying and the little data collected by other agencies is often incompatible with that of the Forest Service.

The impact of human presence on sensitive natural systems throughout the Ecosystem is the source of

virtually all conflict in the area. Logic suggests that some way be devised to determine the extent of impact in advance of administrative actions. For example, the most serious ecological impacts of development activities result from access roads. Roads frequently increase erosion and pollute the clear streams and lakes upon which many animal species depend. Of perhaps more importance, however, is the human presence which results from access roads. Yet road construction and access decisions are determined for each resource activity; there is no coordinated consideration of the effects of roads and access on the Ecosystem.

The problem of coordination extends to the existing "coordination committees" themselves. A review of the data is convincing that the committees are inadequate to provide a comprehensive, integrated overview of the Ecosystem. The Greater Yellowstone Coordinating Committee excludes several important agencies, such as the Bureau of Land Management, State wildlife agencies, and possibly one or more of the National Wildlife Refuges. Other committees focus on one animal species or issue, suggesting a fragmented approach to coordination. In addition, there may be duplicative efforts because of the multiple committees on some issues.

Even where the expertise and commitment exist within a coordinating body, there is serious reason to believe that the data needed to support many decisions simply is not available. The Report reveals that data on activities in the Ecosystem, and on the effects of those activities, is incomplete and inconsistent among the Federal agencies. It is insufficient to evaluate management choices and hence to resolve conflicts in a lasting manner and on the basis of facts. Perhaps the most striking example of this concerns the recording of grizzly bear kills. Two agencies submitted data which can only charitably be called "at variance." They differed in practically every category: number of kills, location, cause, etc. This is particularly disturbing in the case of the grizzly--a preeminent creature in the Ecosystem, expressly protected by an Act of Congress, whose well-being is supposedly the highest priority of each Federal agency.

Adequacy of data depends on thoroughness and

quality of research. Only the Forest Service has a research branch which is independent of its land managers, and can therefore relatively easily conduct studies which last beyond limited personnel tenures. The structure of research efforts, as well as the scope, therefore affects the agencies' ability to generate good data that translates into good decision-making.

Although the jurisdictions of the various Federal agencies in the Greater Yellowstone Ecosystem are a matter of historical record, one is nevertheless struck, when perusing the Report, by how much the Federal government's administrative boundaries can affect comprehensive, coordinated management. Regional boundaries fragment the area into three Forest Service Regions, two Fish and Wildlife Service Regions, and three Bureau of Land Management State Offices. Even within the regions, individual unit boundaries often have little relevance to the Ecosystem. Four of the Forest Service Ranger Districts include lands distantly separated from those in the Ecosystem. In virtually all agency decision-making, the whole is subordinated to its fragments.

Recommendations:

The Report documents the most serious deficiency: an inadequate data base. Data varies from non-existent to very good to inconsistent, and it varies from agency to agency, from issue to issue and within the same agency. Yet the agencies manage roughly the same type of terrain containing generally the same wildlife and often similar human activities. If data underpinning management decisions vary, then the decisions most likely will vary despite the best intentions to achieve commonality.

The Report also documents inconsistencies in current attempts to achieve coordination. The Subcommittees appreciate two recent coordination attempts taken as a result of the joint hearing. The Forest Service and National Park Service have agreed to improve contacts, and the Forest Service has assigned "lead agency" responsibility to a single National Forest in coordinating approaches to resource management in the Ecosystem. However, Report data can

lead one to question whether "more of the same" will adequately address the continuing problem of coordination.

The Report deserves thorough review by all parties interested in resolving conflicts in the Greater Yellowstone Ecosystem. Obviously, disagreements will continue, but hopefully they will take into account the data (or lack thereof) contained in the Report.

The observations set forth in these paragraphs represent "first impressions". They attempt to single out those deficiencies that reasonable people would agree must be overcome if a more rational, coordinated management scheme is to be devised.

In holding the hearing, the Subcommittees hoped to stimulate discussion on new approaches to old problems. Clearly, little can be said here that will move opposing forces to early agreement on such controversial topics as oil and gas leasing, below-cost timber sales, and the like. But suggestions can be made for improvements in data collection and management, on the coordination of multi-agency management efforts, and on certain of the more outstanding resource problems on which consensus is possible. In this spirit, the following suggestions are made:

Data Collection - The agencies basically need to gather management statistics in a more comprehensive and coordinated fashion. Department of Interior agencies especially need to begin collecting such information. When it is gathered, it needs to be in a form which can be shared and understood by other agencies. Likewise, the Forest Service should review its definitions to assure that they conform to common usage --or can at least be easily translated into common usage.

One agency, presumably the Inter-agency Grizzly Bear Committee, should be specially charged with gathering the data on grizzly bear deaths and told to make this a regular part of its agenda. The Fish and Wildlife Service is

required by law to consult under Section 7 of the Endangered Species Act. That it does not have up-to-date and accurate statistics immediately available for use in these consultations is deplorable, to say the least.

Data Management - A central clearing house for Greater Yellowstone Ecosystem data would go far toward standardizing and making available data collected by the land managing agencies. It is therefore suggested that a non-land managing agency be given that responsibility. The U.S. Geological Survey is in the process of perfecting a digital cartography program that is ideally suited for this task. In this exciting program, data is computerized and plotted with great precision for retrieval in map form. The agency could receive information from all sources, feed it into a Geographic Information System, and make the data base available to all agencies, including city and local governments (who would be encouraged to submit data also). Federal agencies would be required to develop compatible data bases. With the Geological Survey leading by providing both hardware and software, the main data base should include (in addition to standard geographic data on topography, roads, ground cover, ownership, etc.), at a minimum:

a. Geologic data on energy and mineral resources;

b. Energy and mineral leases and claims, mines, drill sites, etc., to the extent that they are known;

c. Past and future timber sales;

d. Recreation sites;

e. Visitor use patterns;

f. Existing and proposed water development projects;

g. Grazing allotments;

h. Maintenance levels of roads;

i. Grizzly bear death locations, and statistics on cause of deaths, with supplementary material in narrative form describing the deaths;

j. Eagle nests, whooping crane sites, trumpeter swan sites, ungulate calving grounds, migration corridors;

k. Impediments to animal movements;

l. Hunting and fishing concentrations;

m. Trails and trailheads; and

n. Historical and archeological sites.

Care would need to be taken to protect from public disclosure certain information, such as the location of critical bird nesting areas or archeological sites, if such disclosure could result in harm to fragile resources.

Research - Emulate the practice of the Forest Service by requiring agencies, particularly the National Park Service, to establish research arms that are separate from the land managers. It would also be useful, for example, to have the Fish and Wildlife Service do a comprehensive biological survey of the area: all species present, distributions, numbers and other data.

Coordination - The numerous, duplicative coordinating committees need to be coordinated themselves. Among the options that might be considered are the following:

1. Eliminate some or all of the current committees and replace them with a more comprehensive one.

2. Make the Greater Yellowstone Coordinating Committee responsible for:

   a. assuring that all relevant

Federal, State, and local agencies (including water management agencies) are included in the coordinating committee;

b. assuring relevant participation in the various subcommittees set up to examine specific issues (bald eagle management, whooping crane recovery, pregrine falcon recovery, road access decisions, etc.);

c. coordinating research efforts of the various agencies and universities; and

d. assuring consistent data collection among the agencies involved in the Yellowstone area.

Boundaries - Consideration should be given to adjusting existing administrative boundaries, especially Ranger Districts, within the Ecosystem so that information collected in that administrative area would automatically feed into a central data base.

Human Activities - Human presence in the Ecosystem--in whatever form, be it in connection with resource development or with hunting and hiking--is ultimately associated with virtually all conflict there. While Congress is trying to resolve such controversial matters as oil and gas leasing, some effort should be made to address the overall issue of human access, with special attention paid to the timing of human presence. Since the bulk of the access is via road, this issue should be given top priority. The carrying capacity of the Greater Yellowstone Ecosystem should be determined in a comprehensive manner, prior to decisions on resource management. Options might include:

1. A committee could coordinate current road planning activities, and recommend adjustments when conflict or duplication

might occur.

2. A comprehensive road management plan could be developed for the Ecosystem, with the plan including:

    a. road construction locations and standards,

    b. required road maintenance levels (including costs),

    c. road closure standards (location and timing), and

    d. road destruction for any roads slated for elimination.

3. A committee could establish zones within the Ecosystem which define not only the appropriate levels but the timing of human presence, taking into consideration the requirements of wildlife and other resources in the area.

Grizzly Bears - Two outstanding facts would lead the most impartial observer to conclude that the Federal grizzly bear management program in the Greater Yellowstone Ecosystem is flawed: deaths continue, and statistics on those deaths are suspect. Compliance with existing law requires improvement in both areas. Therefore, the following are advanced for consideration:

1. Scrap the Management Situation concept. Create instead "zones of density" of grizzly bear use and adjust human and grazing access accordingly.

2. Eliminate the so-called grizzly bear "black holes" by targeting enforcement in these areas and following with vigorous prosecution.

3. Conduct thorough forensic investigations of bear kills and include in statistics greater precision on cause of death,

location, etc.

Other Wildlife - More data should be acquired on non-game species in the Greater Yellowstone Ecosystem, and more attention should be given to fish as "indicators" in the Ecosystem. Fish are a prime source of food for many other species and a good indicator of habitat for others (e.g., trumpeter swans). By extension, a similar increase of attention should be given to protection of all riparian habitat.

The foregoing recommendations do not necessarily require legislation. Much can, and should, be initiated by the agencies themselves. It is hoped that these suggestions can help all interested parties better understand the issues involved, and that future Congresses will not hesitate to take whatever further action--by way of oversight or legislation--that may be required to ensure that proper management policies, coordination and cooperation are achieved to protect the Greater Yellowstone Ecosystem.

JOHN F. SEIBERLING
Chairman, Subcommittee

BRUCE F. VENTO
Chairman, Subcommittee
on National Parks
and Recreation

Committee on Interior and Insular Affairs
U.S. House of Representatives

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Congressional Research Service
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Washington, D.C. 20540

YELLOWSTONE:
ECOSYSTEM, RESOURCES, AND MANAGEMENT

Prepared at the Request of:

Hon. John F. Seiberling, Chairman
Subcommittee on Public Lands

and
Hon. Bruce F. Vento, Chairman
Subcommittee on National Parks and Recreation

for the use of the

COMMITTEE ON INTERIOR AND
INSULAR AFFAIRS

M. Lynne Corn
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December 12, 1986

ABSTRACT

This report summarizes and evaluates information on the lands and resources in and around Yellowstone National Park. The information was provided by numerous Federal and several State agencies in response to questions from the House Interior Subcommittees on Public Lands and on National Parks and Recreation. The report describes the Yellowstone ecosystem and its major resources, identifies the development activities in the area, and considers the effects of those activities on the ecosystem and its resources. The report also examines grizzly bear distribution and mortalities as an example of development's effects on an "indicator species," and evaluates the inter-agency coordination in managing the Federal lands of the region. The report presents numerous findings; the most significant are:

1. Grizzly bears are useful indicators of the health of the Yellowstone ecosystem, and their populations trends provide useful information on the effects of land and resource management in the area.

2. The "Management Situations" concept for grizzly habitat management is not particularly effective for preventing grizzly bear deaths. There are seven concentrations of grizzly deaths -- grizzly bear black holes -- in and around Yellowstone National Park. Preservation of grizzly bears requires special attention to these areas, and to the causes of deaths in these areas.

3. The most significant impacts of human developments on the Yellowstone ecosystem result from the access required for virtually all development activities in the area. Access has two effects:

   a. Roads that provide most forms of access can seriously degrade water quality. Many species of animals (especially fish) require clean water, and the Yellowstone ecosystem depends on large volumes of clean water which are produced in the area.

   b. Human activities can disturb and displace many species of animals. Some species, such as grizzly bears, are particularly sensitive to human presence, but many of the other animals important to the ecosystem (elk and bald eagles, for example) can be, or have been, displaced by developments.

4. The existing information and coordination mechanisms are inadequate to provide the comprehensive coordinated management needed to maintain the balance in the Yellowstone ecosystem. Comprehensive data did not exist for any aspect of management or of the ecosystem (including grizzly bear mortalities). Some coordinating committees appear duplicative, while for others, membership and focus is incomplete. Finally, the existing administrative boundaries and organizations tend to restrict, rather than assist, information gathering.

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INTRODUCTION

Yellowstone National Park, the world's first national park, was created by an Act of Congress in 1872,[1] protecting more than two million acres of spectacular natural beauty, including geysers, waterfalls, lakes and mountains in what is now Montana, Idaho, and Wyoming. In the floor debate on the bill, Congressman Henry L. Dawes (R-Mass.) stated:[2]

> [The headwaters of the Yellowstone River] is a region of the country seven thousand feet above the level of the sea, where there is frost every month of the year, . . . containing the most sublime scenery in the United States except the Yosemite valley, and the most wonderful geysers ever found in the country.
>
> The purpose of the bill is to preserve that country from depredations . . . .

In the past century, development and human population have increased in nearby areas outside the Park. Biologists have noted that the rare species found in the Park have ranges that extend beyond Park boundaries into these areas of increasing development and that most species depend on resources outside the Park for some part of their life cycle. Geologists and physical scientists are investigating the hydrological connections between Yellowstone's unique geothermal features and watersheds in nearby forests.

Scientists have therefore come to recognize that preserving the many of the unique features of the Park is at least partly dependent on management of the surrounding lands. Many feel the Park is too small to protect its living and geological resources adequately and that management of lands around the Park should be integrated into the management of a larger "Greater Yellowstone Ecosystem."

DEFINING A YELLOWSTONE ECOSYSTEM

Yellowstone National Park is dominated by a high plateau, surrounded by still higher mountains, which are in turn surrounded by

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[1]Act of March 1, 1872; ch. 24, 17 Stat. 32. 16 U.S.C. Chapter 1, Subchapter V.

[2]Dawes, Henry L. The Congressional Globe, v. 45, Feb. 27, 1872: 1243.

lower plains with less rainfall. The animal and plant communities in the plateau and surrounding mountains have distributions that reach well outside Park boundaries. The Park and its surrounding mountains form perhaps the largest relatively undisturbed ecosystem in the contiguous United States.

An ecosystem is a "unit made up of all the living and nonliving components of a particular area that interact and exchange materials with each other."[3] Given such a definition, the existence of a "Greater Yellowstone Ecosystem" is a scientific construct, rather than a legal designation, and is independent of any congressional action. Moreover, as this definition makes clear, it is possible to set only general -- not precise -- boundaries on any ecosystem, because animals move. It is simply impossible to draw a line through any area and then assert that one independent ecosystem lies on one side and another on the other side. A lack of agreement on boundaries should be expected from a scientific viewpoint. Even so, the concept is used to identify clusters of plants and animals which appear together, and are generally different from those in surrounding areas. Observers may agree that some general area can be identified which includes the majority of the organisms in the ecosystem and their essential physical requirements. The ecosystem approach can then be useful as a management tool.

HEARINGS ON THE GREATER YELLOWSTONE ECOSYSTEM

A number of conflicts have surfaced in the Yellowstone area. There have been charges that timber harvests damage grizzly habitat, that oil, gas, or geothermal drilling will damage Yellowstone's geysers, that grizzly bear populations are incompatible with heavy visitor use, and that the National Parks and/or National Forests are being managed in favor of animals to the detriment of people or the local economy. Animal populations are, in fact, affected by many types of activities, including timber harvesting, water development, grazing, energy and mineral development, and recreation. Conversely, these resources are affected by the requirements of wildlife, as well as many of the activities encountered in economic development of the other resources.

The House Interior Subcommittees on Public Lands and on National Parks and Recreation responded to public concerns about management of Yellowstone National Park and its environs by holding an oversight hearing on the Greater Yellowstone Ecosystem (GYE) on October 24,

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[3]Daintith, John, and Elizabeth Tootill. A Dictionary of Biology. Intercontinental Book Productions, Ltd. Maidenhead, Berkshire, England. 1980. 282 p.

1985.[4] The purposes of the hearing were (1) to examine the meaning and significance of the Greater Yellowstone Ecosystem, its natural, cultural, and recreational resources, and their associated economic and environmental values; (2) to identify the various resource uses and the potential conflicts among them; and (3) to review the strengths and weaknesses of the State and Federal arrangements for managing the ecosystem and its resources.[5]

Request for Additional Information

Lengthy testimony from Federal agencies, organizations, and individuals went far toward meeting those purposes, but the Subcommittees were left with numerous unanswered questions about resource management in the Greater Yellowstone Ecosystem. In order to evaluate the many issues raised at the October 1985 hearing, the Public Lands and National Parks Subcommittees, with the assistance of the Congressional Research Service (CRS), prepared follow-up questions for the Federal and State agencies responsible for managing portions of the area. These questions were addressed to the agencies listed in Table 1, and Appendix I lists the questions asked of each agency regarding lands and their management in the CGYR.

This list of agencies which provided information to the Subcommittees is a nearly comprehensive compilation of Federal agencies with activities in the Yellowstone area. The Minerals Management Service, which collects royalties from energy developments on Federal lands, is the only Federal agency identified in the course of this analysis which was not surveyed. Additional State agencies, local governments, and the Indian tribes could probably have supplemented the data provided to the Subcommittees, but the agencies listed above represent the vast majority of those interested and involved in managing the Yellowstone ecosystem.

Area for Which Information Was Provided

Respondents had to have some geographical limits to reply, so CRS analysts were asked to prepare a map to assist the agencies in responding. The map's boundaries were chosen to include similar topography and climate zones as well as similar vegetation. For administrative convenience, legal boundaries (such as Ranger Dis-

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[4]U.S. Congress. House. Committee on Interior and Insular Affairs. Subcommittee on Public Lands and Subcommittee on National Parks and Recreation. Greater Yellowstone Ecosystem. Oversight Hearing, Oct. 24, 1985. 99th Congress, 1st Session. Washington, U.S. Govt. Print. Off., 1986. 697 p. Serial No. 99-18. (Hereafter referred to as Greater Yellowstone Ecosystem Oversight Hearing.)

[5]Seiberling, John F. Opening Remarks. Greater Yellowstone Ecosystem Oversight Hearing. p. 2.

TABLE 1. Agencies Providing Information on Resource Management in the Greater Yellowstone Ecosystem

DEPARTMENT OF AGRICULTURE
- U.S. Forest Service
- Animal and Plant Health Inspection Service

DEPARTMENT OF THE INTERIOR
- National Park Service
- Bureau of Land Management
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Bureau of Indian Affairs
- Bureau of Reclamation
- Office of Surface Mining
- Bureau of Mines

OTHER FEDERAL AGENCIES
- Advisory Council on Historic Preservation
- Department of Energy - Bonneville Power Administration, Federal Energy Regulatory Commission
- Department of Commerce - National Oceanic and Atmospheric Administration
- Department of Defense - Army Corps of Engineers
- Environmental Protection Agency

STATES of Montana, Idaho and Wyoming Historic Preservation Offices
IDAHO Department of Fish and Game
MONTANA Department of Fish, Parks, and Wildlife
WYOMING Department of Game and Fish

tricts, township lines, etc.) were used where they approximated natural boundaries. Every effort was made to include all areas discussed in any way at the Subcommittees' hearing in October, 1985. Map 1 shows the area for which information was asked; it will bereferred to as the "Committee's Greater Yellowstone Map", or "CGYM" in this report, and the region contained within the CGYM will be called the CGY Region or "CGYR".

The CGYR is displayed in Map 1, which shows graphically topographic and other features of the area. Table 2 identifies the acreage managed by each of the major administrative units, while Figure 1 (p. 6) shows the administrative units for the various Federal land managing agencies in the CGYR. The total land area of the CGYR is about 14 million acres. Of this, the U.S. Forest Service is the largest landowner, with 10.2 million acres in seven National Forests. The National Park Service manages 2.6 million acres in Yellowstone National Park (NP), Grand Teton NP, and the John D. Rockefeller, Jr., Memorial Parkway connecting the two Parks. The U.S. Fish and Wildlife Service has three Refuges in the CGYR, with 73,000 acres, while the Bureau of Land Management (BLM) manages about 126,000 acres, predominately in the Madison River Valley and around Red Rock Lakes National

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TABLE 2. Land Ownership in the CGYR
(est. = estimated)

Landowner or Manager	Acreage
Yellowstone National Park	2,219,803
Grand Teton National Park	306,865
J.D. Rockefeller Parkway	27,777
National Park Service Subtotal	2,554,445
National Elk Refuge	24,247
Red Rock Lakes National Wildlife Refuge	32,467
Grays Lake National Wildlife Refuge	16,153
U.S. Fish and Wildlife Service Subtotal	72,867
Beaverhead National Forest	473,250 est.
Gallatin National Forest	1,550,100 est.
Custer National Forest	509,500 est.
Shoshone National Forest	2,433,029
Bridger-Teton National Forest	3,400,110
Caribou National Forest	628,250 est.
Targhee National Forest	1,193,900 est.
U.S. Forest Service Subtotal	10,187,900 est.
Idaho BLM Lands	4,500 est.
Montana BLM Lands	76,500 est.
Wyoming BLM Lands	45,000 est.
BLM Subtotal	126,000 est.
Idaho State Lands	44,600 est.
Montana State Lands	69,250 est.
Wyoming State Lands	3,000 est.
State Land Subtotal	116,850 est.
Champion Timberlands	142,000 est.
Other Private Landowners	800,000 est.
Total Land in the CGYR	14,000,000 est.

Wildlife Refuge (NWR). (BLM land ownership was estimated from maps provided by the Forest Service.) Thus, the Federal Government owns about 12.9 million acres in the CGYR, more than 90 percent of the total land area. The States also own land in the CGYR, with Idaho owning an estimated 45,000 acres and Montana owning about 70,000. The remaining one million acres are privately owned. The largest private landowner is Champion Timberlands, a forest products company; Champion owns about 142,000 acres in the Gallatin and Madison Ranges, northwest of Yellowstone NP.

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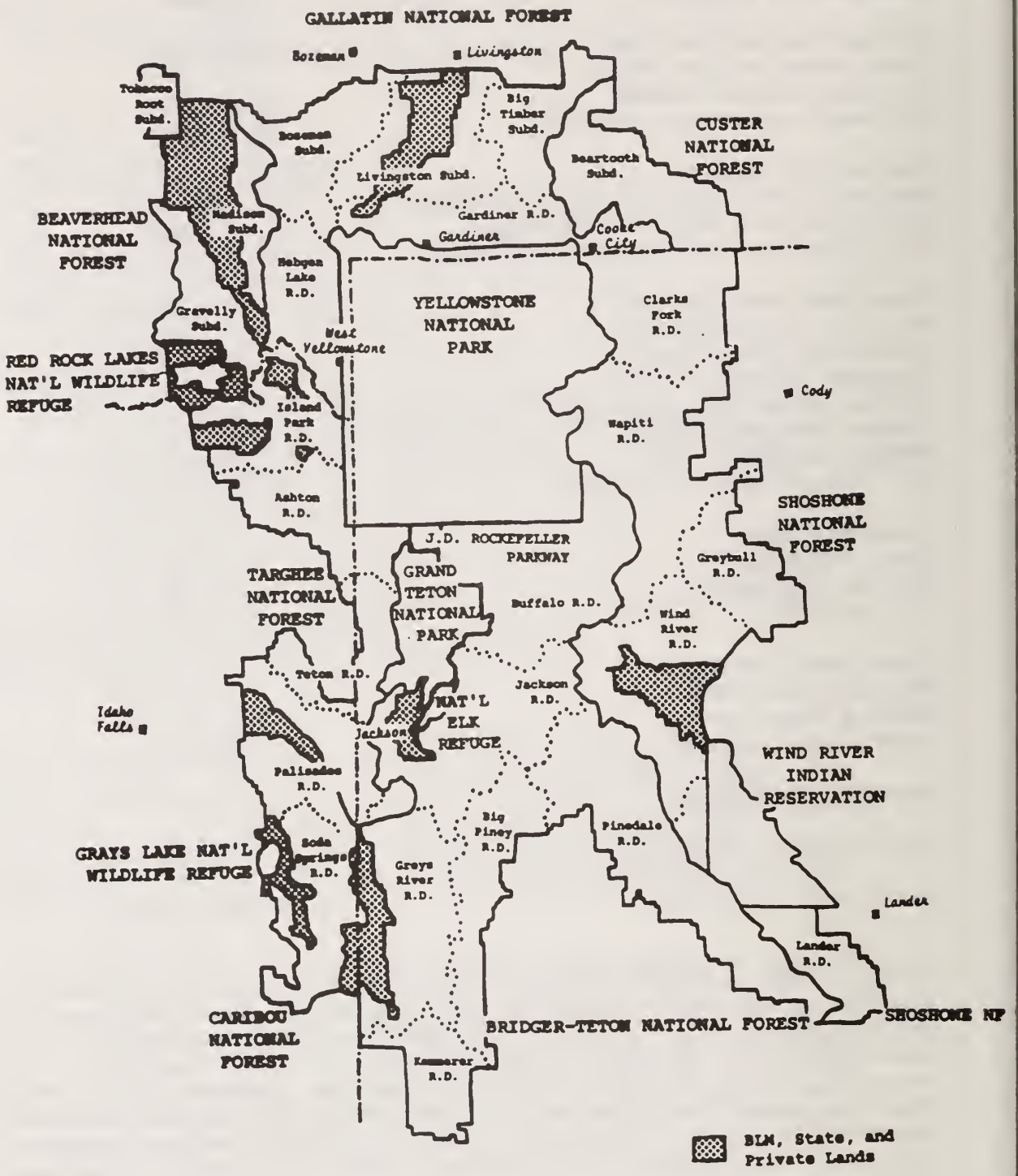
FIGURE 1. Federal Administrative Units in the CGYR



New Information

As a general rule, the Federal agencies created no new data to respond to the Subcommittees' questions. Most of the data existed in files scattered among the various Federal agencies; in many instances, the information was not actively used in managing the area. This report, therefore, contains virtually no data which did not previously exist. However, the existing data on the Yellowstone ecosystem and on the development activities on various Federal lands in the Yellowstone area has never before been compiled into a single document. Thus, this report provides "new" information, in the sense that the data had not previously been compiled and readily available. In addition, the maps accompanying this report are the first spatially descriptive documents which identify most development activities and other important factors in examining the Yellowstone ecosystem. The significance of this report, therefore, is not in new data, but rather in the broad compilation of existing data -- beyond agency boundaries -- and the analysis of the interrelationships of these activities with the ecosystem.

PURPOSE OF THIS REPORT

The primary purpose of this report is to summarize and evaluate the additional information provided to the House Interior Subcommittees by the various agencies. Thus, this report can provide the basis for future congressional oversight on Federal activities affecting the Greater Yellowstone Ecosystem. The report also provides a comprehensive view of Federal land management in the area, and reveals opportunities for management adjustments that result from such a view. Similarly, such opportunities illustrate the value of a comprehensive view in examining land management for areas where the activities of one agency can affect the lands and resources of another agency. Thus, this approach may prove useful in examining resource conflicts in other units of the National Park System and other such lands.

This report is organized into several chapters. Chapter II describes the natural state of the Yellowstone ecosystem. Chapter III describes how various development processes and activities affect the natural system; the development activities discussed include timber harvesting, water developments, grazing, energy and mineral management, and recreation. Chapter IV describes several significant site-specific conflicts between grizzly bears, as indicators of the health of the ecosystem, and other uses. Finally, Chapter V discusses issues related to inter-agency coordination and management.

THE YELLOWSTONE ECOSYSTEM

This chapter describes the physical features of the CGYR which help to distinguish it from surrounding lands. It is followed by a description of major vertebrate species which help define the ecosystem, and which have been the focus of special controversy. The important findings of this analysis are:

1. The Yellowstone ecosystem still contains the great majority of the species present in the past. With the first signs of the return of the whooping crane and the peregrine falcon, the wolf is the only large vertebrate originally present that is still completely missing from the CGYR.

2. The populations of many animal species, such as bald eagles and trumpeter swans, have been affected by development activities on or near critical habitats.

3. Fish, especially cutthroat trout, are food sources for many species in the CGYR, and play a critical role in the health of the ecosystem.

4. Grizzly bears are important as <u>indicators</u> of the health of the Yellowstone ecosystem, because:
   a. Areas of prime importance to grizzlies are also important to other species (bald eagles, trumpeter swans, elk, fish, etc.);
   b. Grizzlies are sensitive to human intrusions; and
   c. Grizzlies often die in human-bear encounters; these deaths are concentrated in certain areas.

5. Forest Service and Park Service lands are currently divided into grizzly bear Management Situations, or zones. These Management Situations do not accurately reflect important grizzly habitat and use.

PHYSICAL FEATURES

The geology (elevation and landform) and hydrology of the Yellowstone area distinguish it from the surrounding countryside. These features help determine the plant and animal communities which can develop, and thus aid in defining the limits of an ecosystem.

Geology

The Yellowstone area is an identifiable land form, distinct from the surrounding area.[6] It is characterized by a high plateau composed of old lava flows (with an average elevation of 8000 feet), centered in Yellowstone National Park. The plateau is virtually surrounded by several high mountain ranges. (See Map 1.) Grand Teton Peak in Grand Teton NP is the highest mountain in the area, at 13,747 feet, but more than 40 peaks in and around Yellowstone NP exceed 10,000 feet. The area surrounding the CGYR is dominated by lower elevation plains (under 6,000 feet in elevation) dotted with hills and low mountains. The area is, in effect, an island of mountains in the dry plains of the West.

The three principal geologic provinces form the foundation of this ecological island: the Yellowstone Volcanic Plateau, the Overthrust Belt, and the Northern Rocky Mountain Province. Most of Yellowstone NP and the area southwest of the Park contain volcanic rocks, with calderas (volcanically formed basins) in the Park and near Island Park Reservoir; the geothermal resources of the Yellowstone Volcanic Plateau are related to the geologically recent volcanic activity. The Overthrust Belt, along the Idaho-Wyoming border, is characterized by many thrust faults running from northwest to southeast in the southern half of the CGYR.[7] These thrust faults have created structural traps for hydrocarbons. The Northern Rocky Mountain Province, to the east and north of the volcanic plateau, is characterized by mountain ranges of volcanic or Precambrian rocks, separated by river valleys. These three geological provinces are distinct from the bedrock of the surrounding plains.

Two high mountainous ridges extend from the Yellowstone area -- the Wind River Range to the southeast and the Salt River and Wyoming Ranges to the south. These ranges are geologically similar to the mountains surrounding the volcanic plateau of Yellowstone National Park. Some descriptions of the Greater Yellowstone Ecosystem exclude the southern parts of these ranges, but their geology distinguishes them from the surrounding plains and they historically had flora and fauna similar to those found in Yellowstone NP.

Hydrology

The high plateau and mountains receive more than twice as much precipitation as the surrounding plains. Annual snowfall exceeds six feet (about six inches of precipitation) throughout most of the area,

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[6]U.S. Department of the Interior, Geological Survey. The National Atlas of the United States of America. Washington, U.S. Govt. Print. Off., 1970. p. 62.

[7]U.S. Geological Survey response to Subcommittees' questions. Map of geologic features.

while the plains generally receive less than three feet of snow (about three inches of precipitation). Precipitation in the CGYR, including snowfall, averages more than 32 inches per year, while the surrounding plains average less than 16 inches of precipitation annually. The greater precipitation in the CGYR allows for substantially different plant and animal communities than can develop in the surrounding plains.

The high elevations and precipitation levels in the CGYR mean that the area contains the headwaters for several rivers -- the Snake River, the Green River (which flows through Flaming Gorge to the Colorado River), and numerous tributaries of the Missouri River (most notably the Yellowstone River). Because of the numerous rivers originating in the CGYR, the National Weather Service maintains a detailed hydrometerological network (consisting of numerous rain and stream gauges and snow measuring stations) in the area.[8] This also implies that activities which alter the hydrology of the CGYR can have effects far beyond the boundaries of the area.

The most famous features of Yellowstone are probably the geysers and hot springs. While other places also have geysers -- notably Iceland and New Zealand -- none can match the size, power, or number of geysers in Yellowstone National Park. The sources of groundwater for Yellowstone's hydrothermal system is still under investigation. The U.S. Geological Survey has reported a similarity between the waters in the Yellowstone hydrothermal system and rainwater (collected in surface water and cold springs) in the Gallatin Mountains, suggesting that recharge for the Yellowstone hydrothermal basin comes from the mountains to the north and northwest of the Park.[9]

Finally, Red Rock Lakes are an important hydrologic feature of the CGYR. These lakes are located about 30 miles west of Yellowstone NP, near the Continental Divide. Although not in the central plateau or the surrounding mountains, their warm springs may be linked to Yellowstone's hydrothermal systems and the lakes are heavily used by the animal communities that help define the ecosystem.

FORESTS

The higher elevation and greater precipitation of the CGYR cause its vegetation to differ from the sagebrush and grasses of the surrounding plains. The CGYR is heavily forested, but there are numerous meadows and open creek bottoms, and sagebrush flats in the central plateau.

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[8]National Oceanic and Atmospheric Administration response to Subcommittees' questions.

[9]USGS response to Subcommittees' questions. p. 37. Also, personal communication with Alfred Truesdell, U.S. Geological Survey, Menlo Park, CA. September 15, 1986.

The extensive forests of the CGYR help define the ecosystem, but data on forests are generally available only for commercial timberlands and not on forests where timber harvesting is restricted. Commercial timberland includes lands which are available for harvesting and meet the minimum growth requirement, but with no allowance for such potentially limiting factors as soil stability or accessibility [10]; thus, commercial timberland can include areas which may never be harvested. All National Park lands, most National Wildlife Refuge lands, and all Federal wilderness areas are excluded from commercial timberland, because laws prohibit timber harvesting in these areas. Thus, harvesting is prohibited on nearly seven million acres, so data on forests are unavailable for at least half of the Federal lands in the CGYR.

Table 3 shows the 1.76 million acres of commercial timberland in the CGYR (see also Figure 2, p. 14); this is 17.5 percent of the National Forest land in the area. Wilderness and wilderness study areas (WSAs), where timber harvesting is prohibited, account for 4.26 million acres (42.3 percent) of the National Forest land in the CGYR. The remaining 40 percent of National Forest land in the CGYR is excluded from commercial timberland for various, unspecified reasons, and very little information exists on the vegetation of these areas. (The BLM also manages commercial timberland in the CGYR, although the acreage and location are not known.) The commercial timberland is heavily concentrated in the Targhee National Forest (NF). This can be explained partly by the amount of wilderness north, east, and south of Yellowstone National Park (as shown in Map 8), but 77 percent of the non-wilderness lands in the Targhee have been identified as commercial timberland, while less than 20 percent of non-wilderness lands in the other National Forests in the CGYR are considered commercial timberland.

Lodgepole pine dominates the forested area, accounting for more than half of the commercial timberland in the CGYR, as shown in Table 4 and Figure 3. The other major timber types include Douglas-fir, Engelmann spruce/ subalpine fir, and aspen. (See Effects on Other Resources under Timber Harvesting, p. 48, for a further description of the effects of timber harvesting on wildlife.)

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[10] "Commercial timberland [is defined as] forest land which is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as commercial timberland have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently, inaccessible and inoperable areas are included.)"

U.S. Department of Agriculture, Forest Service. An Analysis of the Timber Situation in the United States, 1952-2030. Forest Resource Report No. 23. Washington, U.S. Govt. Print. Off., Dec. 1982. p. 496.

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TABLE 3. Commercial Timberland by National Forest
(in thousand acres)

	Total Acreage	Wilderness & WSA Acreage	% of NF	Commercial Tbrland Acreage	% of NF
Beaverhead NF	436.5	108.4	24.8%	48.2	11.0%
Gallatin NF	1,540.0	815.3	52.9%	263.9	17.1%
Custer NF	519.0	345.6	66.7%	62.0	11.9%
Shoshone NF	2,433.0	1,393.8	57.3%	85.5	3.5%
Bridger-Teton NF	3,400.1	1,384.2	40.7%	231.9	6.8%
Caribou NF	362.0	0.0	0.0%	166.9	46.1%
Targhee NF	1,380.1	212.7	15.4%	902.8	65.7%
CGYR Total	10,070.7	4,260.0	42.3%	1,761.2	17.5%

TABLE 4. Commercial Timberland by Timber Type
(in thousand acres; * = combined with Douglas-fir;
** = combined with Lodgepole Pine)

	Commercial Timberland	% of CGYR	Lodgepole Pine	Douglas-fir	Spruce/Fir	Aspen
Beaverhead NF	48.2	2.7%	29.4	10.1	8.7	0
(% of Forest)			61.0%	20.9%	18.1%	
Gallatin NF	263.9	15.0%	189.7	74.2	*	0
(% of Forest)			71.9%	28.1%		
Custer NF	62.0	3.5%	62.0	**	**	0
(% of Forest)			100%			
Shoshone NF	85.5	4.9%	40.5	9.6	35.4	0
(% of Forest)			47.4%	11.2%	41.4%	
Bridger-Teton NF	231.9	13.2%	156.9	6.9	68.2	0
(% of Forest)			67.6%	3.0%	29.4%	
Caribou NF	166.9	9.5%	40.5	30.7	20.8	74.3
(% of Forest)			24.6%	18.4%	12.5%	44.5%
Targhee NF	902.8	51.2%	482.7	330.3	*	89.7
(% of Forest)			53.5%	36.6%		9.9%
CGYR Total	1,761.2		1,002.2	461.8	133.2	164.0
(% of CGYR)			56.9%	26.2%	7.6%	9.3%

Figure 2. Commercial Timberland by National Forest

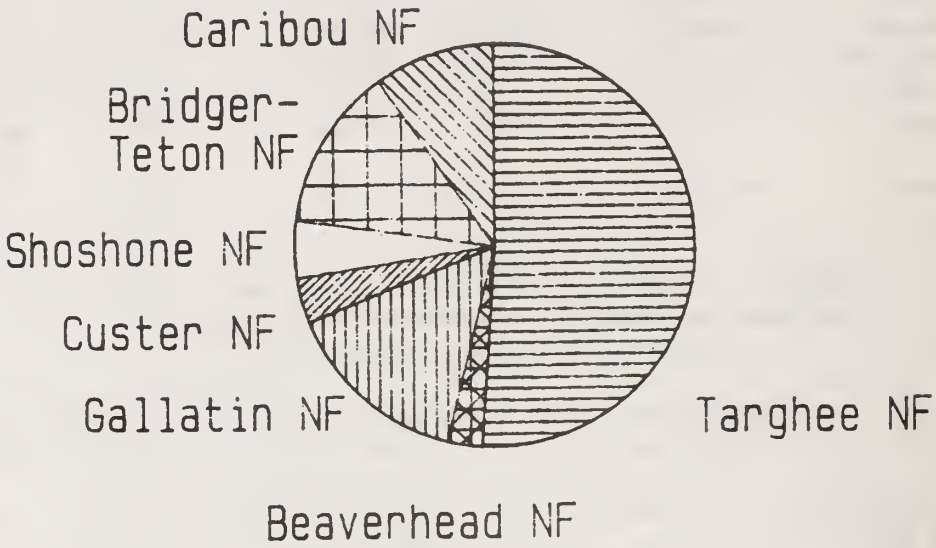
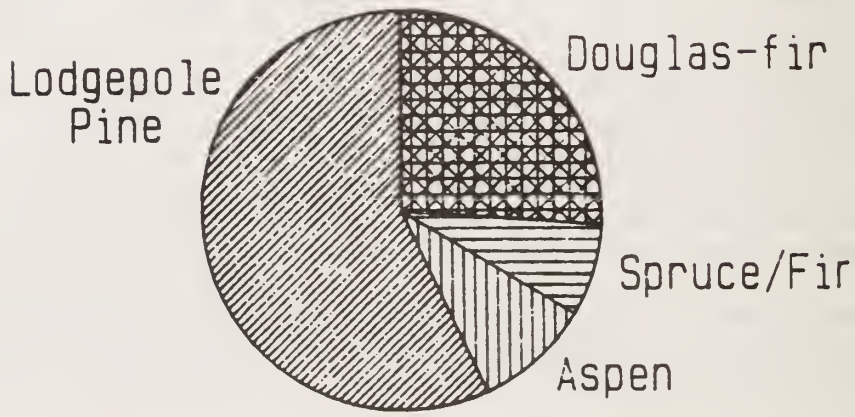


Figure 3. Commercial Timberland by Timber Type



Lodgepole Pine

The CGYR contains the largest continuous expanse of lodgepole pine (Pinus contorta) in the United States. Lodgepole pine typically grows in extensive even-aged stands interspersed with few other tree species, because its life cycle is linked to insect-caused mortality and severe wildfires which kill off other species in a wide area. The mountain pine beetle is a native insect throughout the western United States. It survives at low population levels until the lodgepoles mature, then beetle populations expand rapidly, killing the mature trees; in northwestern Wyoming, beetle epidemics are typically restricted to stands of lodgepoles greater than 14 inches in diameter (generally 140 or more years old).[11] (See Map 2 for locations of heavy insect infestations in the CGYR.) The trees killed by the beetles increase the available fuel, eventually contributing to devastating wildfires. However, throughout much of its range, lodgepole pine has adapted to wildfire by developing serotinous cones: the cones generally remain closed until the heat of a fire releases the seeds. Thus, the conflagrations can lead to regeneration of the lodgepole stands. (Lodgepole pine can regenerate naturally without fire, because some seeds are released without the heat of a wildfire.) The insect-and-fire cycle causes a the natural rotation (the age when trees die of natural causes) of about 150 years for lodgepole pine in the CGYR.

More than a million acres of Federal commercial timberland in the CGYR contain lodgepole pine, accounting for 57 percent of the National Forest timberland in the CGYR. Nearly half of this is in the Targhee NF, with the Gallatin and Bridger-Teton Forests accounting for substantial portions. Nearly two-thirds of the lodgepole pine stands exceed the standard harvest age on the National Forests (90 years), and 16 percent of the acreage has trees over 140 years old. (More than 75 percent of the lodgepole stands on the Bridger-Teton are over 140 years.) Thus, many areas are approaching the natural rotation age for lodgepole pine, with increasing risks from insects and from wildfire.

Douglas-fir

The lodgepole pine stands are interspersed with stands of Douglas-fir (Pseudotsuga menziesii var. glauca), particularly at the lower elevations. Douglas-fir also typically grows in even-aged stands. Insects play a lesser role in Douglas-fir stands, although there are scattered heavy infestations of western spruce budworm and of Douglas-fir beetle. Douglas-fir has a longer natural rotation than lodgepole pine, generally exceeding 200 years in the CGYR. Douglas-fir stands are also even-aged, because they are often affected by the

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[11] Lotan, James E. and David A. Perry. Ecology and Regeneration of Lodgepole Pine. Agriculture Handbook No. 606. Washington, U.S. Dept. of Agriculture, March 1983. p. 12.

same fires that determine the lodgepole cycle, and because Douglas-fir generally regenerates most successfully on sunny (cleared) sites.

Douglas-fir grows on more than a quarter of the commercial timberland in the CGYR National Forests. The heaviest concentrations of Douglas-fir are generally west of Yellowstone National Park, on the Targhee and Gallatin Forests. Most of the Douglas-fir stands (84 percent) are older than the standard harvest age (120 years old) for the National Forests of the CGYR. Nearly 70 percent of the Douglas-fir acreage is between 120 and 140 years old, with only 14 percent exceeding 140 years of age. Thus, the Douglas-fir stands are fairly uniform in the mature age (and size) class, but are not presently endangered from natural causes.

Some concerns have been expressed over regeneration of Douglas-fir. The species is common throughout the western United States, and Douglas-fir is typically replanted on sites where it has been harvested. However, the Idaho Department of Fish and Game asserted that Douglas-fir sites are being replaced by lodgepole pine or open fields in the CGYR:[12]

> The USFS has been unsuccessful in regenerating Douglas-fir stands. Repeated plantings have failed with no planted trees surviving beyond five years. Consequently, most logged Douglas-fir sites are either devoid of trees or are being planted to or invaded by lodgepole pine. . . . We feel that the current program of Douglas-fir harvest on Federal, State and private land will severely reduce and perhaps eliminate this habitat type in the Idaho portion of the GYE.

The agency stated that the permanent loss of Douglas-fir stands would be harmful to many of the wildlife species in the area.

Spruce/Fir

South and east of Yellowstone, particularly at the higher elevations, the forests become dominated by Engelmann spruce (Picea engelmannii) and subalpine fir (Abies lasiocarpa). Insects are even less of a problem for spruce/fir forests than for Douglas-fir, and fires tend to be less devastating, because the higher elevations are cooler, moister, and have less continuous stands of trees. As a result, the natural rotation for spruce/fir is up to 300 years (depending on the species), and spruce/fir forests often have a variety of ages throughout the stands.

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[12]Idaho Department of Fish and Game response to Subcommittees' questions. p. 2.

The spruce/fir forests occur on less than eight percent of the commercial timberland in the CGYR. This timber type is most common on the Bridger-Teton and Shoshone Forests. Nearly 20 percent of the spruce/fir forests (all on the Shoshone NF) are sufficiently varied to be classified as uneven-aged forests. Most of the remainder (an additional 66 percent of the spruce/fir acreage) is more than 140 years of age, and thus approaching (albeit slowly) the natural rotation for the timber type.

Aspen

In addition to the conifers described above, aspen (Populus tremuloides) is scattered throughout the area, and accounts for significant timberland acreage in the Targhee and Caribou National Forests. Despite the substantial acreage of aspen timberland, aspen is not harvested commercially in the CGYR. A variety of diseases limit the life-span of aspen, and the natural rotation is only about 75 years in the CGYR.

ANIMALS

The status and well-being of the animals of the Yellowstone area have been at the heart of many of the concerns about this area. The area's many jurisdictional boundaries do not limit the range of bears, fish, whooping cranes, elk, and other animals. Coordinating the management of these species requires not only exceptional cooperation among the many responsible agencies, but also detailed knowledge of the animals' resource needs and movements. The animals' needs may be at odds with the legal mandates or preferred policies of the agencies, or their accommodation may require substantial modification of the normal means used to achieve the desired goals. Moreover, successfully coordinating management may be easier for some species than for others.

Not only is there a problem in preventing the extinction or local loss of species: there is an equally serious problem in preventing introduction of non-native species which may damage or destroy vital, delicate, symbiotic, co-evolved systems. For an example, one need look no farther than Olympic National Park (ONP). At ONP, introduced mountain goats are destroying delicate alpine plant life which (due to long isolation from large grazing mammals) has never evolved -- or has lost -- adaptations that permit the species to survive. While deliberate introduction of non-native species by management professionals is now relatively rare, the Greater Yellowstone Ecosystem, with its high visitation rates, is still vulnerable to accidental introductions, or deliberate introductions by irresponsible individuals. From gypsy moths to brook trout to mountain goats, the ecosystem's plants and animals are surrounded by potential invaders. An example of an invasion that was nearly successful will be discussed under Non-Native Species under Recreation (p. 102).

The ecology of each species in an ecosystem is tied to that of every other species in the ecosystem. Actions affecting one may have an unpredictable effect on many other species, as is seen easily in the reports of the introduction of house cats to remote islands or rabbits to Australia or of the loss of Atlantic salmon to the eastern United States. Species strongly dependent on one or a very few food items may be wiped out if that food disappears, but species dependent on a wide range of resources may be able to shift, at least for a time, to other resources.

When too many of these alternative resources are destroyed, the eclectic species may also be lost. Many of the controversial species in the CGYR are eclectic in their food choices: grizzlies, bald eagles, and peregrine falcons. In these cases, food shifting may temporarily conceal losses of habitat or habitat quality but sometimes the replacement resources themselves become depleted. Other species (whooping cranes, trumpeter swans) may also take many foods, but only in a restricted habitat. Only preventing the loss of this habitat can ensure the preservation of these species.

Habitat fragmentation -- the separation of usable habitat into disjunct units -- can be a particularly acute problem for a wide-ranging species like the grizzly. Timber activities could inhibit grizzly access from Yellowstone Park to surrounding heavily used habitat. There may be travel corridors of forest cover and limited human intrusion linking areas heavily used by bears. These connecting links may therefore have an importance out of proportion to the number of bears in them at any given time. Breaks in these travel corridors could reduce or eliminate grizzly use of important habitat by removing the cover that allows free grizzly bear movement. At this point, not enough is known about specific cover requirements of grizzly bears to identify methods of modifying timber management and other development activities to provide adequate cover.

Forest Service consideration of local fauna in land management planning relies on the concept of "indicator species." At each Forest, managers select vertebrate and/or invertebrate animals as indicator species because "their population changes are believed to indicate the effects of management activities."[13] Indicators may be selected "because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality."[14] All species listed under Federal law as threatened or endangered are required to be treated as indicator species by the Forest Service. Once the Forest Service has chosen a species as an indicator, the agency must take various specific steps to consider the well-being of the species in management planning.

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[13]36 C.F.R. 219.19 (a)(1).

[14]36 C.F.R. 219.19 (a)(1).

The grizzly bear (Ursus arctos horribilis), listed as a threatened species in the lower 48 States, is now found in all of the seven National Forests in the CGYR except the Caribou, and is an indicator for the other six. Because important grizzly habitat is frequently important habitat to other species as well, as shown below, its status as an indicator species is appropriate.

The grizzly bear and other species of mammals, birds, and fish which have been the focus of special controversy or attention are discussed below. Sometimes called "charismatic megafauna," their discussion below is grouped taxonomically, beginning with grizzly bears -- by far the most controversial species in the CGYR. In each case, the habits, range, and populations are discussed, with emphasis on how each species is or might be affected by human activities or management decisions.

Grizzly Bears[15]

Habits

Grizzly bears (Ursus arctos horribilis) are the largest terrestrial carnivores in the contiguous United States, but their diet is more appropriately called omnivorous, since it includes a wide variety of plants.[16] In the spring, bears typically feast on the carcasses of elk, deer, and other animals which died and whose decomposition was slowed by the area's harsh winter. Small rodents, active in the remains of their winter tunnels, are caught by bears. Grizzlies will also attack elk and moose when these animals are still weak from winter's effects. An occasional moose or elk calf is eaten, and bears congregate at streams in the spring to catch the spawning cutthroat trout. These various protein resources are particularly important for the female bear whose cubs are born months before she leaves her hibernation den. The growing cubs and yearling bears are also dependent on these foods. Later in the summer, bears shift to plant matter, such as sedges, clover, glacier lilies, tubers, berries, and

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[15]This section covers grizzly bears, rather than black bears (Ursus americanus). Black bears are seen far more frequently than grizzlies in Yellowstone, although the black bear population is also declining. However, black bears are not endangered, are more tolerant of human developments, and rarely threaten human lives; thus, studies of their populations appear less critical to understanding the effects of activities on the ecosystem.

[16]For more discussion of grizzly diet and its seasonal variations, see: Picton, H.D., D. M. Mattson, B. M. Blanchard, and R. R. Knight. Climate, Carrying Capacity, and the Yellowstone Grizzly Bear. In Proceedings -- Grizzly Bear Habitat Symposium. [Compiled by Glen P. Contreras and Keith E. Evans.] Forest Service General Technical Report INT-207. Ogden, UT, May 1986. p. 129-135.

the nut caches of squirrels. They also eat the insects in rotten logs or underneath animal dung.

Grizzlies feed during much of the night and particularly at dawn and dusk. During the day, bears rest in thick groves of trees where they construct a shallow day bed. While visiting a special foraging area such as a field of strawberries, they retreat to nearby islands of trees during the day.

Among the behaviors that are of special interest in terms of forest management needs are the bears' uses of cover in forested areas, but there is surprisingly little information on this subject. Any study of their behavior while in such areas is logistically difficult for several reasons. First, it would be difficult to find a bear in such an area unless the bear is radio collared. Second, bears are often gregarious during their daytime rest periods, and observations of a known bear could put the investigator in danger from unknown bears. Third, the presence of an observer close enough to monitor a bear's behavior in dense cover could make the bear aware of the observer, and lead to modification of the bear's activities or to danger of arousing aggressive behavior from the bear.

During the fall, bears begin searching for suitable denning sites for winter hibernation. These sites are typically at elevations between 7800 and 9200 feet, very isolated from human disturbance, in timbered areas, with an entrance facing north.[17] The northern exposure allows snow to drift over the entrance, providing further insulation for the den. Bears typically dig their dens at the bases of trees, rather than adapting some natural chamber. Dens are not reused, but the general site often is. According to one study,[18] bears in the CGYR enter their dens each year between October 21 and November 21, with early winters leading to early denning. Bears often dig their dens days or weeks in advance but wait for an approaching snowstorm to enter the den -- a behavior that guarantees that their tracks will be covered by falling snow, and may reduce the risk of being found by predators.

Population Levels

Under the Endangered Species Act, grizzlies are listed as threatened in the contiguous United States, with only six populations remaining. At a minimum of 183-207 bears[19], the population in the CGYR is one of the largest. Estimating population size has been

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[17]Craighead, Frank C., Jr. Track of the Grizzly. San Francisco, Sierra Club Books, 1979. p. 105.

[18]Craighead, Track of the Grizzly. p.106.

[19]Knight, Richard R. and L. L. Eberhardt. Populations Dynamics of Yellowstone Grizzly Bears. Ecology, v. 66, no. 2 (1985): 326.

controversial ever since a 1960s decision by the National Park Service to reduce the access of bears to open garbage pits. At the time, some authorities argued that the closure of garbage pits was desirable in order to discourage unnatural concentrations of bears around these food sources, and to return the bears to a more natural diet. Critics charged that such a sudden withdrawal of an important food source would seriously damage an already precarious population, and that closure, while desirable, should be done much more gradually.

When the number of counted bears dropped following the closure, a few observers claimed that the drop was merely an artifact of the more difficult counting methods that were now required, rather than a real decline in the population. Most authorities now agree that a drop in population did occur.[20] Moreover, the average age of females at the time of their first litter has risen from five to six years, the average litter size has decreased, and the weights of some bears have decreased,[21] all changes which are consistent with food stress. The controversy may never be resolved to everyone's satisfaction, particularly since the Park Service removed radio collars and ear tags from a large number of bears at the time of the dump closings. Since that time, many additional bears have been radio-collared and tagged, and aerial counts have been taken, and reports on the details of each sighting of a grizzly are made to managers. The population now shows a long term decline of 1.7 percent per year.[22]

Recovery

The number of reproductively active females generally defines the rate of growth that is possible for any population. In the case of grizzlies, whose females produce cubs only once every two or three years, "[a]dult females constitute the crucial component of the population, inasmuch as the difference between a 'recovering' population, and one sinking towards extinction presently amounts to the loss of one or two adult females per year",[23] since there were only 32 female bears of reproductive age were estimated to be in the population as of 1984.[24] The saving of even one adult female bear per year "is roughly equivalent to [increasing] the litter size from the

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[20]Knight and Eberhardt, Population Dynamics. p. 331.

[21]Knight and Eberhardt, Population Dynamics. p. 331-332.

[22]Knight and Eberhardt, Population Dynamics. p. 326-327.

[23]Yellowstone National Park response to Subcommittees' questions. Enclosure 2: Knight, R.R., B.B. Blanchard, and L.L. Eberhardt. Mortality Patterns and Population Sinks for the Yellowstone Grizzly Bear, 1973-85. Draft manuscript, submitted for publication. p. 3.

[24]Turbak, Gary. Grizzly on the Ropes. American Forests, v. 90, no. 2 (Feb, 1984): 22-23, 48-49.

present value to that prevailing when the garbage dumps were available as a supplementary food supply."[25]

As bears approach areas of human concentration, they increase their risk of conflict and the associated risk of death, whether from illegal hunter or stockman kills, legal management control actions, road kills, self-defense actions. Therefore, a crucial factor in the bears' recovery is the tendency of the bears to wander. Bears have a tendency to use an area repeatedly when a favored food source is available. Bears learn from their mothers and from their own experience when a particular root, berry, or seed is available, and return at the appropriate time of year to a site where food has been found in the past. Use of a particular meadow, stream, or grove of trees might therefore be very intensive, but limited to only a small part of the year.

A given bear might, in any single year, visit only certain parts of the Park System or wilderness areas. But over the course of several years, the bear is likely to wander over a far larger area, thus virtually guaranteeing that it will leave lands affording the greatest Federal protection. In addition to the normal wandering shown by bears, there is an increase in wandering during dry years, when important food supplies are reduced.[26] These worst-case years of high wandering, and accompanying risk of bear mortalities, can be predicted in the short term on the basis of rainfall patterns.

Some parts of the CGYR might be called "black holes" for bears, due to their concentrations of bear mortalities.[27] Map 3 shows these "black holes" are around towns; second home and resort developments; relatively undeveloped roadless areas; and at heavily developed campsites. Surprisingly, the U.S. Fish and Wildlife Service did "not have the specific localities for each of the mortalities through the years."[28] Data from the State of Wyoming concerning deaths in the entire CGYR show that over the last decade, more than half the grizzly deaths were illegal kills. (See Table 5.)

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[25]Knight and Eberhardt, Population Dynamics. p. 331.

[26]Picton, et al., Climate, Carrying Capacity, and the Yellowstone Grizzly Bear. p. 134.

[27]In astronomy, a "black hole" is a "hypothetical celestial body with small diameter and intense gravitational field . . ."; among its characteristics is an intense attraction for matter, which -- once the matter comes within the black hole's vicinity -- is unable to escape the area. (Source: Webster's New Collegiate Dictionary. Springfield, MA, G. and C. Merriam Co., 1975. p. 115.)

[28]U.S. Fish and Wildlife Service (FWS) response to Subcommittees' questions. p. 11.

TABLE 5. Mortality Causes for 112 Grizzly Bear Deaths in the Yellowstone Area From 1976-1985

Mortality Cause	Number Recorded	% of Mortalities
Natural	18	16.1
Management Control	18	16.0
Research/Management Accident	6	5.4
Road Kill	5	4.5
Self Defense	2	1.8
Illegal	60	53.5
Unknown	3	2.7
Total	112	100.0

In Table 5, "Management Control" refers to the deliberate killing or removal of bears from the ecosystem. (Wyoming included removed bears since, from the standpoint of the recovery of the bear population, removed bears are equivalent to dead bears.) "Research/Management Accident" includes bears which might die during attempts to put collars or tags on them or which are killed when, say, being moved to a more remote area.

With rare exceptions, grizzly bears are now found only in Yellowstone National Park and its immediate surroundings. The areas used most heavily by the bears are shown in Figure 4. This map is based on the best data available since 1970, using observations by experienced individuals and airplane sightings. The authors made every attempt to avoid biases created by the presence of an observer, and to base the map on bear density alone.

In the mid-1970s the Fish and Wildlife Service proposed critical habitat for this population of bears under the requirements of the Endangered Species Act (16 U.S.C. 1533). The proposal was withdrawn, in favor of a system of "situations" or zones of management. The regulations designating these situations (designated as Management Situations I to V or MS-I through MS-V) specify the level of consideration that will be given to the bears' requirements within those zones, with MS-I being the most restrictive of activities that conflict with the bears' needs. (These Management Situations are described in Table 6, p. 25.) The Forest Supervisors and National Park Superintendents are charged with deciding the locations of the Situation boundaries in their jurisdictions.[29]

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[29]U.S. Department of Agriculture, Forest Service. Guidelines for Management Involving Grizzly Bears in the Greater Yellowstone Area. Denver, CO, 1979. p. 3.

FIGURE 4. Distribution of Sightings of
Unmarked Grizzly Bears, 1970-1981

Cross-hatching indicates areas of highest use; slanted lines mean high density; solid lines delineate areas where sightings are common, while the dashed lines indicate areas of occasional sightings. The outer rectangular dashed line is used as "bear range" by various agencies. Based on Knight and Eberhardt's Figure 1, provided by R. R. Knight.

TABLE 6. Grizzly Bear Management Situations
Source: U.S. Department of Agriculture, Forest Service. Guidelines for Management Involving Grizzly Bears in the Greater Yellowstone Area. Denver, CO, 1979. p. 3-4.

MANAGEMENT SITUATION I	
Population and habitat conditions. The area contains grizzly population centers (areas key to the survival of grizzlies where seasonal or year-long grizzly activity, under natural, free-ranging conditions is common) and habitat components needed for the survival and recovery of the species or a segment of its population. The probability is very great that major Federal activities or programs may affect (have direct or indirect relationships to the conservation and recovery of) the grizzly.	Management direction. Grizzly habitat maintenance and improvement (improvement applies to Forest Service only), and grizzly-human conflict minimization will receive the highest management priority . . . . Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land use values compete. Land uses which can affect grizzlies and/or their habitat will be made compatible with grizzly needs or such uses will be disallowed or eliminated. Grizzly human conflicts will be resolved in favor of the grizzlies unless the bear involved is determined to be a nuisance. Nuisance bears may be controlled through either relocation or removal but only if such control would result in a more natural free-ranging grizzly population and all reasonable measures have been taken to protect the bear and/or its habitat (including area closures and/or activity curtailments).
MANAGEMENT SITUATION II	
Population and habitat conditions. The area lacks distinct grizzly population centers; highly suitable habitat does not generally occur, although some grizzly habitat components exist and grizzlies may be present occasionally. By definition, management situation 2 areas are those considered unnecessary for species survival and recovery, although the status of such areas is subject to review and change according to	Management direction. The grizzly bear is an important but not the primary use on [sic] the area. Habitat maintenance and improvement, and grizzly-human conflict minimization may be, in some cases, important, but not the most important management considerations. Demonstrated grizzly populations and/or grizzly habitat use will be accommodated in other land use activities if feasible, but not the extent of exclusion of other use needs. A feasible accommodation is one which is compatible with (does not make unattainable) the major goals and/or

demonstrated grizzly population and habitat needs. The effects of major Federal activities or programs on the conservation and recovery of the species are not generally predictable.

objectives of other uses. When grizzly population and/or grizzly habitat use and other land use needs are mutually exclusive, the other land use needs will prevail in management considerations. If grizzly population and/or habitat use represents demonstrated needs that are so great (necessary to the normal needs or survival of the species or a segment of its population) that they should prevails in management considerations, then the area should be reclassified under Management Situation 1. Nuisance grizzlies will be controlled.

MANAGEMENT SITUATION III

Population and habitat conditions. Grizzly presence is possible but infrequent. Developments, such as campgrounds, resorts or other high human use associated facilities, and human presence result in conditions which make grizzly presence untenable for humans and/or grizzlies. There is a high probability that major Federal activities or programs may affect the species' conservation and recovery.

Management direction. Grizzly habitat maintenance and improvement are not management considerations. Grizzly-human conflict minimization is a high priority management consideration. Grizzly bear presence and factors contributing to their presence will be actively discouraged. Any grizzly involved in a grizzly-human conflict will be controlled. Any grizzly frequenting an area will be controlled.

MANAGEMENT SITUATION IV

Population and habitat conditions. Grizzlies do not occur, but habitat and human conditions make the area potentially suitable for grizzly occupancy, and the area is needed for the survival and recovery of the species. The probability is very great that major Federal activities and programs may affect the species' conservation and recovery.

Management direction. The grizzly bear is an important potential use on [sic] the area. Grizzly habitat maintenance and improvement are important management considerations. Grizzly-human conflict minimization is not a management consideration. Habitat and human conditions making the area suitable for grizzly occupancy will not be degraded pending decisions regarding reestablishment of grizzlies.

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MANAGEMENT SITUATION V

Population and habitat conditions. Grizzlies do not occur, or occur only rarely in the area. Habitat may be unsuitable, unavailable, or suitable and available but unoccupied. The area lacks survival and recovery values for the species or said values are unknown. Major Federal activities and programs probably will not affect species conservation and recovery.	Management direction. Consideration for grizzly bears and their habitat in other resource related decisions is not directed. Maintenance of grizzly habitat is an option. Any grizzly involved in a grizzly-human conflict will be controlled.

Few, if any, activities are prohibited on the strength of these regulations alone,[30] but the regulations may require that certain activities be slowed, modified, or restricted in various ways. In many cases, zone boundaries in National Forests coincide with, or are similar to, wilderness boundaries; in the Shoshone, for example, the MS-II lines are identical to wilderness boundaries for considerable distances, even where these boundaries are straight lines. (Compare Maps 3 and 8.) Even now, there appear to be substantial discrepancies between the boundaries of the Situation areas as drawn by the Forest Service and by the U.S. Fish and Wildlife Service.[31]

The differences between the Situation map (Map 3) and Figure 4, can be important, especially if the Situation I, II, and III areas are misinterpreted as meaning areas of high, medium, and low bear use or density. Three areas illustrate the problem. The area north of Yellowstone Park is considered by Knight and Eberhardt to be of the highest density of bear use. Yet much of this area, where visitor use is extremely high, is considered Situation II by the National Park Service, a fact which further illustrates that Situation maps are not bear density maps. In fact, the bear densities and the number of bear deaths and removals that have occurred in the area around Fishing Bridge would appear to contradict the definition of "Population and

[30]For example, several timber sales have been proposed in MS-I areas in various National Forests. (See "Effects on Fish and Wildlife" under "Timber Harvesting" for more details.) Livestock grazing occurs in MS-I areas, as well.

[31]FWS and Forest Service responses to Subcommittees' questions. Grizzly Bear Management Situation map overlays. Whether the differences are real, or simply errors by one or both agencies is not clear. No pattern (e.g., one agency consistently drawing larger boundaries than the other) was evident.

habitat conditions" quoted under Situation II in Table 6. Similarly, the area north and east of Hebgen Lake is also "highest density" for bears, yet the Gallatin National Forest considers a substantial portion of the area to be only Situation II. The fate of the proposed Ski Yellowstone development could be affected by this difference. (See Downhill Skiing under Recreation, p. 86.) Finally, the mortality black holes noted above lie in both Situation I and II. (For an analysis of factors affecting each mortality concentration, see Grizzly Bear Mortality Clusters, p. 115.)

Wolves

Wolves (Canis lupus) form a special case in the analysis of the fauna of the CGYR, in that they are no longer found there: they were deliberately exterminated from the Yellowstone ecosystem in the early part of this century. In 1915, the military administration of Yellowstone called for the removal of wolves as a way of protecting prey species such as elk, deer, antelope, and other herbivores. When Yellowstone passed into the civilian hands of the newly created National Park Service a few years later, the killing continued, and the wolf population was essentially wiped out in the next few decades, although sporadic sightings of one or two wolves continued for many more years.

John Weaver, a biologist for the Forest Service, noting the huge populations of large ungulates[32] in the Yellowstone area, stated "To have a large population of ungulates without such a predator [wolves] in the system is unnatural. . . . [Y]ou're missing a primary component of the whole system."[33]

The effect of predators on their prey populations is currently on of the more significant topics in theoretical population biology. In the wolf/ungulate interaction at CGYR, two extremes seem possible: First, kills by wolves could be added on top of current mortality, and total mortality of ungulates would increase, causing prey population growth to slow or drop. Second, at the other extreme, all prey taken by wolves might consist of animals so weakened that wolves merely hastened death from other causes by days or weeks. (Obviously, some intermediate between these extremes is also possible.) Thus, to the extent that wolves were merely taking animals which would have died soon of other factors, such as parasites or harsh weather, total mortality would also be unaffected. Houston, for example, leans to the second extreme in suggesting "that predators are unable to prevent large ungulates from being resource limited in a large number of

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[32]An ungulate is any mammal having hooves. In the CGYR, this includes such species as elk, deer, moose, pronghorn antelope, and mountain sheep.

[33]Quoted in: Return of the Native. [by Christopher Cauble.] National Parks, v. 60, no. 7-8 (July/August 1986): 24.

ecosystems, particularly if the large ungulates are migratory and are also the most abundant of several alternative prey."[34] Theberge and Gauthier have provided a recent summary of studies of wolves and their effects on prey populations. Of eighteen studies they reviewed, seven concluded wolves were the major limiting factor on the ungulate prey; five concluded that the wolves were not; and six concluded that weather, forage, and human hunting confounded the predator-prey relationship.[35]

Historical evidence may be instructive. Using such archeological and historic evidence, Houston[36] suggests that early wolf densities were low in spite of large populations of ungulates. If so, the ungulate populations were more likely limited by the harsh winters than by predation. The extensive historical and recent scientific research on the ungulates of the CGYR make it an important, even unique, testing ground for such theories if wolves are reintroduced. Scientists are waiting to test predator/prey theories in the cold light of real observations at Yellowstone.

Bison

There are about 2000 bison (Bison bison) in Yellowstone National Park.[37] The majority of the population remains in Yellowstone National Park throughout the year, but roughly three to five percent of the animals use the areas adjacent to Yellowstone National Park during part of the year, particularly in winter. The principal conflict from this "leakage" of this slowly growing population is with livestock grazing, particularly because bison carry brucellosis, a disease which attacks cattle, sheep, goats, pigs, and certain other domestic mammals. The disease causes abortion, stillbirths, birth of sick young, and infertility. Transmission occurs through contact with fetal membranes and fluids. However, since the bulk of the herd remains in the Park, conflicts regarding disease or other problems have been rare. The Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture notes that the only uncontrolled source of brucellosis in the area is from the herds of bison and elk centering in the Park.[38] However, APHIS considers

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[34]Houston, Douglas B. The Northern Yellowstone Elk. New York, Macmillan Publishing Co., 1982. p. 194.

[35]Theberge, John B. and David A. Gauthier. Models of Wolf-Ungulate Relationships: When Is Wolf Control Justified? Wildlife Society Bulletin, v. 13 (Winter 1985): 449-458.

[36]Houston, The Northern Yellowstone Elk. p. 194.

[37]Personal communication with John Varley, Chief of Research, Yellowstone National Park. October 8, 1985.

[38]APHIS response to Subcommittees' questions. Cover letter.

domestic herds in Wyoming and Montana free of the disease and rates Idaho below 0.25 per cent. The leaky areas around Yellowstone National Park are along the northern border near Gardiner, on the eastern border in the Shoshone National Forest, and on the western border in the Targhee and Gallatin National Forests.

In the last year, controversy has developed over a sport hunt of the herd north of Yellowstone National Park near Gardiner, Montana. In 1984, unusually large numbers of bison left the Park during the winter. Local ranchers feared the spread of brucellosis, so the Montana Department of Fish, Wildlife, and Parks paid agents to kill 88 of the animals outside of the Park. The Montana legislature declared the animal a game species in 1985. Critics have charged that bison, raised in Yellowstone National Park and unafraid of humans, are not at all suitable for sport hunting--the animals "just stand there and die."[39] State wildlife officials have also objected to the sport hunt, preferring the continuation of a system of professional marksmen, and asking that the National Park Service do more to reduce the growing herds in the Park. In addition, the State's instructions to hunters note that improper handling of the carcasses or improper cooking of the meat can lead to transmission of brucellosis to humans (in whom it is called undulant fever).[40] Proponents of the hunt, including the Montana Wildlife Federation, support the increase in opportunities for hunters, and argue that it is more economical to have hunters pay the State to kill bison than to have the State pay sharpshooters to kill them.[41]

Elk

About 30,000 elk (Cervus elaphus) live in Yellowstone National Park for at least part of the year, but only one of the nine herds there has a winter range almost entirely in the Park.[42] Use of Yellowstone National Park is heaviest in the summer, when elk graze in the higher elevations. In the winter, elk generally leave the Park for lower canyons and other sheltered areas, and return to the high country in the spring. To the general public, this seasonal migration may represent the most obvious and observable dependence of any Yellowstone species on lands outside the Park. Since the elk seem

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[39]Ed Francis, Gardiner area rancher, quoted in: After a 100-Year Hiatus, Bison-Hunting Season Is Set to Begin. New York Times. Nov. 12, 1985.

[40]Montana Department of Fish, Wildlife, and Parks. Montana 1985-86 Buffalo Hunting Season. Regulations and Procedures.

[41]After a 100-Year Hiatus, Bison-Hunting Season Is Set to Begin. New York Times. Nov. 12, 1985.

[42]Personal communication with Frank Singer, Wildlife Biologist, Yellowstone National Park. October 7, 1985.

slightly more likely than bison to spread brucellosis during these migrations (if only because there are 15 times as many elk), it is not clear why the elk have been relatively untouched by the brucellosis controversy.

During the fall migrations to the lowlands, sport hunters (in many of the jurisdictions around the National Parks, especially the National Forests) are the primary cause of elk mortality. But now that the ecosystem lacks one of the elk's previous major predators (wolves), bears have become second to humans as a major predator on the herds. However, the bears' kills are opportunistic, and occur chiefly in the spring. Bears, just emerging from hibernation, attack any weak and starving elk that have barely survived the winter. Bears may also attack elk foundering in deep snow or resting on the ground. Bears do not generally attack elk during the summer when other food sources are readily available, although they will readily feed on elk carcasses, should they find them at any time of year.[43]

Critical areas for elk include the small traditional calving grounds to which females return each year to give birth, as well as low elevation wintering areas. Roads constitute barriers to migration in that elk initially hesitate to cross them. Even after elk become accustomed to a particular road, increased hunter access may present a threat to those elk that use it.

Bald Eagles

The CGYR is home to a substantial portion of the bald eagles (Haliaetus leucocephalus) inhabiting the Rocky Mountain States. Bald eagles are endangered throughout the CGYR, although their populations have risen substantially since use of the pesticide DDT was cancelled in 1972. There are now 55 nesting pairs in the area, including 12 pairs which nest in Yellowstone National Park. The areas used most often by the birds are shown in Map 4. The local population growth of the last 15 years is largely attributed to only six pairs nesting along unusually rich rivers and streams south of Yellowstone National Park.[44]

Fish constitute a major portion of the bald eagles' diet. In fact, the presence of open water in early spring within three miles of a nest site is major distinguishing feature of bald eagle nest sites in the CGYR.[45] Prey species include trout and Utah suckers. Spring

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[43]Craighead, Track of the Grizzly. p. 147.

[44]Personal communication with Robert Oakley, Wyoming Fish and Game Department. October 4, 1985.

[45]Swenson, J. E., K. L. Alt, and R. L. Eng. Ecology of Bald Eagles of the Greater Yellowstone Ecosystem. Wildlife Monographs, no. 95 (April 1986): 15-18.

runs of spawning cutthroat trout are heavily preyed upon by the eagles. Housing development and levees have encroached upon some of the prime fishing habitat. Among the areas so affected is the Snake River near and below Jackson Hole. Increased construction could damage the watershed enough to destroy the cutthroat trout spawning areas. Bald eagles differ from other species considered in this report because the areas likely to be altered by human activities may be the best available eagle habitat in the CGYR, rather than one of many equally suitable habitats.

As these same fish are a favorite food of grizzly bears too, high use eagle areas are often identical to high use grizzly areas and heavily used angling areas. One such nesting area lies just outside Yellowstone National Park in the Thoroughfare Plateau of the Teton Wilderness in the Bridger-Teton National Forest, an area of highest density for grizzly bears (according to Knight and Eberhardt), and an area known for good sport fishing. Several other eagle use areas are coincident with heavy bear densities and high fishing pressure. (Compare Maps 3, 4, and 7.)

Another important food source for bald eagles is the carrion from ungulate carcasses. Eagles may use winter-killed animals in the winter, and in the spring when the eagles feed their nestlings. Unrecovered sport hunter kills may also be used at this time.

In the CGYR, nests occur mainly in lodgepole pine, Engelmann spruce, Douglas-fir, cottonwood, and blue spruce. The Caribou is considering creating nest sites by removing the tops of suitable trees, sometimes with dynamite. However, Swenson et al. do not mention broken tops as a characteristic feature of bald eagle nest sites, but rather stress that once the requirement of nearby access to a reliable food source in the early spring is met, eagles are flexible in their choice of nest sites, and in all parts of the area, a majority of nest sites were in healthy trees.[46] The Custer and the Shoshone have no known bald eagle nests.

The GYE Bald Eagle Working Team (made up of representatives from the three States, the three Forest Service regions, two Fish and Wildlife Service regions, one National Park Service region, and the Idaho State Director of the Bureau of Land Management) has divided the area into three population zones: the Yellowstone Unit, the Snake Unit, and the Continental Unit.[47] (See Figure 5.) In the Yellowstone Unit, the Team says that the two major factors limiting suitable habitat are natural wildfires and increased human use. Two bald eagle nests have been abandoned near Fishing Bridge and Grant Village on Yellowstone Lake due to human developments. Human impact is reduced

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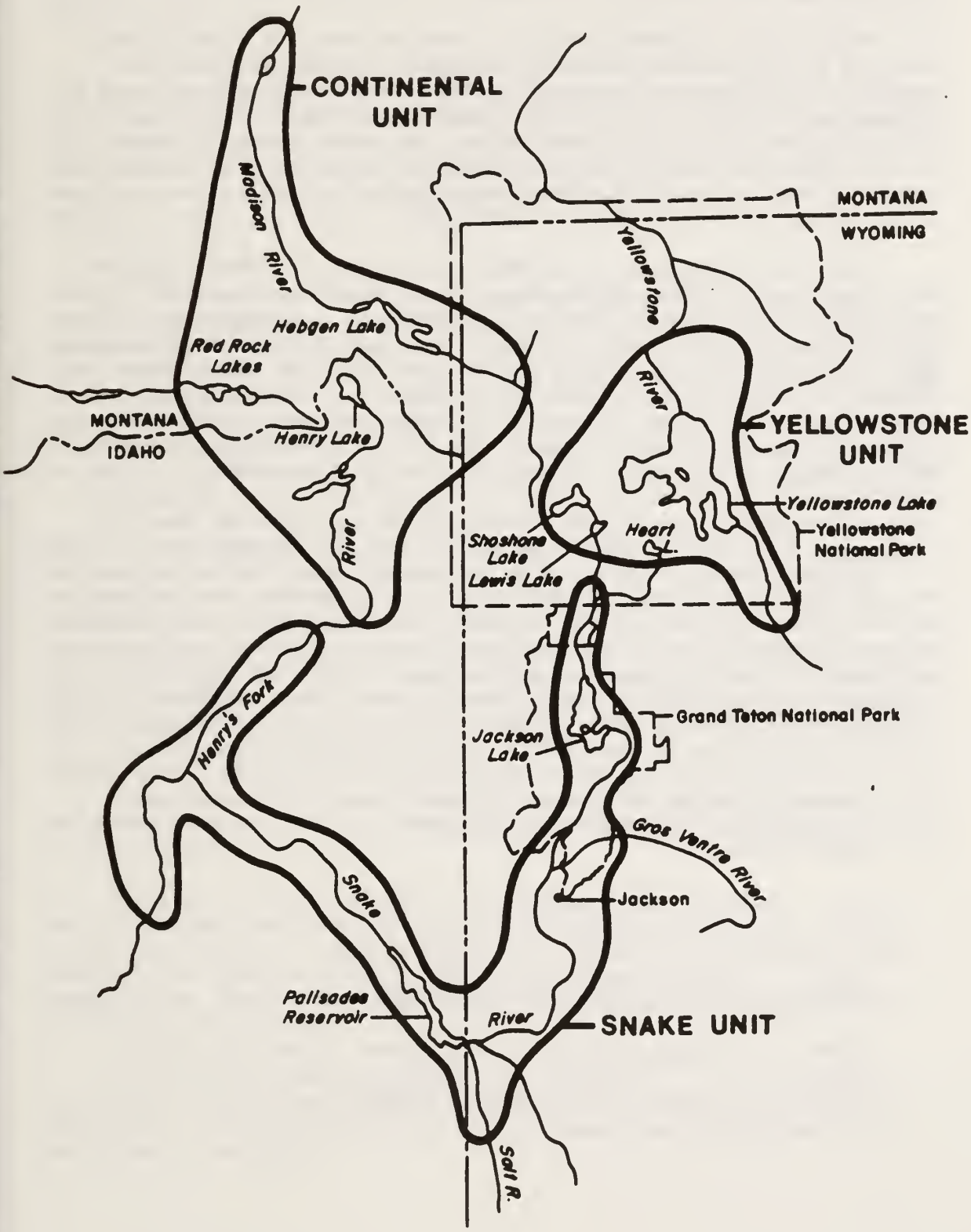
[46]Swenson, et al., Ecology of Bald Eagles of the GYE. p. 15-18.

[47]The GYE Bald Eagle Working Team. A Bald Eagle Management Plan for the Greater Yellowstone Ecosystem. Wyoming Game and Fish Dept., Nov. 1983. 84 p.

FIGURE 5. Map of Bald Eagle Population Units
in the Greater Yellowstone Ecosystem
Source: GYE Bald Eagle Working Team. A Bald Eagle Management Plan for the Greater Yellowstone Ecosystem. Wyoming Game & Fish Dept., Nov. 1983. p. 3.



by travel restrictions due to spring snow depth and by the late (July 15) opening of the fishing season on Yellowstone Lake.

Little winter food is available for eagles in the Yellowstone Unit, and the majority of both adults and immatures leave the area during winter. Many of these birds move to the other two units, but some winter in the Pacific Northwest.[48]

Productivity (fledged young per occupied nest) is significantly lower in the Yellowstone National Park Unit than in the other two. However, the differences in productivity between this and the other two populations are insignificant up through hatching,[49] so the difference must occur during the period the young occupy the nest. The fact that the Yellowstone Unit population continues at current levels is due in part to immigration of eagles from the other two units, which are more productive areas.[50]

The Snake River Unit, according to the Team, has ample prey of many species, with spawning cutthroat trout being particularly important in the spring. This Unit experiences a net increase of adult eagles during winter. It should be noted that the Team's Snake River Unit extended well beyond the boundaries of the CGYM (compare Figure 1 and Figure 5), and the Team commented on the critical importance of the lower portion of the Snake (outside of the CGYM, apparently) to a variety of animals and plants. The Team noted that habitat change in the area, including associated degradation of the fisheries, had occurred as a result of regulation of the Snake River flow. Year-round recreational activity (rafting, fishing, boating, etc.) also disrupts the eagles' habitat along the Snake River.

The Continental Unit includes the upper portion of the Henry's Fork, Red Rock Lakes National Wildlife Refuge (RRLNWR), Hebgen Lake, and the Madison River, all in the CGYR. The Henry's Fork and several of its tributaries remain open throughout the winter due to geothermally warmed water in the area. Disturbance by boaters, housing development, loss of trees due to insects, and timber management to control insect infestations are the chief disruptions of eagle habitat in the Idaho portion of this area. In the Montana portion of the Continental Unit, nesting areas are mainly in Douglas-fir habitat near large bodies of water. Sources of habitat loss in this area are housing development, intrusion by fishermen, recreation development, and timber management.

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[48]Swenson, et al., Ecology of Bald Eagles of the GYE. p. 15-18.

[49]Swenson, et al., Ecology of Bald Eagles of the GYE. 46 p.

[50]Swenson, et al., Ecology of Bald Eagles of the GYE. 46 p.

Peregrine Falcons

Peregrine falcons (Falco peregrinus) prey on domestic pigeons, ducks, herons, crows, and many other birds. Occasionally, they will also take mammals and even insects. The species nests on cliffs and ledges, in the tops of trees, and the unoccupied nests of other species. Some nest sites are occupied for decades by succeeding pairs of falcons.[51]

Peregrine falcons were once nearly extinct in the United States due to the effects of pesticides. As pesticide use declined, captive breeding programs were begun. With reintroduction of the captive-bred falcons into unoccupied but suitable habitat, the species has staged a remarkable comeback, though it is still endangered in most of its range. No breeding pairs of peregrine falcons were located in Idaho, Montana, or Wyoming in 1981-1983.[52]

Peregrine falcon populations are now expanding in the CGYR, though it is still listed as endangered in all parts of the CGYR. A cooperative program of reintroduction sponsored by various Federal agencies (including the National Park Service, the Forest Service, the Fish and Wildlife Service), the various States, and the Peregrine Fund (a private, non-profit organization) has been responsible for this improvement. By establishing young captive birds at "hacking sites" where they are artificially fed for a certain period, researchers hope to induce the falcons to return to the general area when they mature.

To date, 73 male and 76 female peregrines have been reintroduced under this program.[53] Some of these birds have already successfully established nests, including the first known wild peregrine falcon nest in Montana in many years. Heinrich and his coworkers hope to establish 30 nesting pairs in Yellowstone National Park and its surroundings, with approximately 10 pairs in each State. They argue that the establishment of a self-sustaining population will require 50 birds (half males, half females) to be reintroduced each year through 1990. Recovery is slow since many of the birds that are successfully

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[51]Because of the risk of theft of peregrine eggs by illegal collectors, no data are presented in this report on locations of hacking sites.

[52]State of Wyoming response to Subcommittees' question. Enclosure: A Cooperative Proposal for Reintroduction of Peregrine Falcons in Adjacent Areas of Idaho, Montana and Wyoming. [Prepared by Bill Heinrich, Bob Oakleaf, Dennis Flath, and Wayne Melquist.] Unpublished, July, 1986. p. 1. Hereafter referred to as Peregrine Falcon Reintroduction Proposal.

[53]Peregrine Falcon Reintroduction Proposal. p. 5. The total calculated from Figure 2 of the Proposal is 149 birds, although the text claims 156 birds have been reintroduced. The discrepancy is not explained in the paper.

reintroduced do not survive long enough to reproduce, and some may leave the area: one breeding pair is established for every 39 falcons released.[54]

At Red Rock Lakes, the use of lead shot by waterfowl hunters is now banned to reduce the risk to falcons (and eagles) of lead poisoning from feeding on injured birds. With the apparent progress on the reintroduction to the CGYR of this species and the whooping crane, the Greater Yellowstone Ecosystem now lacks only one large vertebrate -- the wolf -- that it was known to have in historic times.

Trumpeter Swans

Trumpeter swans (Cygnus buccinator) are not now listed as endangered. In 1932, the species was thought to be very depleted, and the population in the Yellowstone area was only about 57 resident pairs.[55] The species has recovered substantially since then, but the Yellowstone Ecosystem still represents crucial North American habitat for the species.[56] In addition to breeding birds, there is an even larger number of overwintering swans. Their winter feeding depends upon the geothermal activity throughout the area which prevents many streams from freezing over, since the swans feed on submerged aquatic vegetation. (See Map 4, showing both components of the population.)

There are 300-400 resident birds breeding on small ponds in and around Yellowstone National Park. The Hebgen Lake area of the Gallatin National Forest, the Targhee National Forest near the southwest corner of Yellowstone National Park, as well as parts of the Bridger-Teton National Forest all have substantial resident trumpeter swan populations. However, the major source of trumpeter swans in the area is Red Rock Lakes. Parts of this area have been closed to unauthorized entry to protect the swans. Also, lead shot and lead sinkers are banned at the Refuge to prevent swans from ingesting them. Even so, the refuge officials noted "increasing reproductive difficulties" in recent years, which it attributed in part to cold, wet springs. The Refuge has built and distributed floating nest platforms around the refuge. The design of the nests prevents loss of nestlings to spring floods.[57] Data were not supplied on how frequently the nests are used.

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[54]Peregrine Falcon Reintroduction Proposal. p.8.

[55]Bellrose, Frank C. Ducks, Geese, and Swans of North America. Harrisburg, PA, Stackpole Books, 1976. p. 88.

[56]Personal communication with Ruth Gale, Biologist, Montana Cooperative Wildlife Research Unit. October 7, 1985.

[57]FWS response to Subcommittees' questions. p. 15.

The larger component consists of overwintering birds, including about 95 percent of all the trumpeter swans breeding in Canada. The average number of wintering swans has grown from 816 (1974-1978) to 1460 in 1984.[58] Overwintering swans rely not only on natural vegetation, but also on an artificial feeding program at Red Rock Lakes National Wildlife Refuge. Two small ponds at the east end of the Refuge provide winter habitat for up to 300 swans.

The Fish and Wildlife Service stated that the wintering areas are "really the critical factor" to the swans' success in the area. These wintering areas "need a combination of open water throughout the winter and a supply of submerged aquatic vegetation for feed to provide winter habitat. This habitat cannot be mitigated [sic]. It is in critical supply and any disturbance to these wintering areas critically affects the wintering population."[59]

Whooping Cranes

The Grays Lake National Wildlife Refuge (16,200 acres) is the site of an experimental new flock of whooping cranes (Grus americana), an endangered species which was reduced to a total population of only 21 birds in the 1950s. Map 4 shows use areas for the experimental flock in 1981-1985. These large, long-lived birds pair for life, and feed and nest in marshy areas or along lakeshores. The Grays Lake experimental population represents an ambitious attempt to ensure the survival of the species in the event that a hurricane or other disaster should strike the one remaining natural flock. It is still too early to determine whether this experiment will be successful in establishing a second flock of whooping cranes.

The "whoopers" at Grays Lake are being raised by sandhill cranes acting as foster parents for whooping crane eggs that have been substituted for their own. The sandhill cranes of the Grays Lake National Wildlife Refuge naturally use Yellowstone National Park and Red Rock Lakes National Wildlife Refuge, as well as other wetlands in the CGYR, and their adoptive offspring have followed them into these areas. The first juvenile whooper was seen in Yellowstone National Park in the summer of 1985.[60] (See Map 4 for location of Park use.) With a current population of 30-35 whooping cranes in the Grays Lake

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[58]State of Wyoming response to Subcommittees' questions. Enclosure: Progress Report: Rocky Mountain Trumpeter Swan Population (Wyoming Flock), 1983-1984. [By Dave C. Lockman, Bob Wood, Bruce Smith, Bert Raynes.] Unpublished. p. 2.

[59]FWS response to Subcommittees' questions. p. 15

[60]Personal communication with Wendy Brown, Research Biologist, University of Idaho. October 7, 1985.

flock,[61] it seems likely that the whoopers' use of the CGYR will increase as the birds' numbers increase.[62]

Fish: Salmonids

Salmonid fish (trout and whitefish) are at the heart of the ecosystem's attractiveness for many species, including humans. In the two National Parks, the main species caught are cutthroat, brown, rainbow, brook, and lake trout, as well as mountain whitefish. The Yellowstone cutthroat trout, a local race of this species (Salmo clarki), is a particularly important link in the ecosystem's food chain. This trout lives in Yellowstone Lake, and each spring, adult fish move into the surrounding streams to spawn. Adult mortality during the spawning run is high, since cutthroat trout are an important source of food at this crucial spring period for many species of birds and mammals. Bears, just emerging from hibernation, are among the species' major predators. This timing of the spawning run is critical, since the spring period is when bears, especially females with young cubs, need protein. Certain rare or threatened species -- such as bald eagles, osprey, white pelicans, loons, and otters -- are also heavily dependent on the cutthroat trout.

Many fish species spend most of their lives in lakes and return to fast-flowing streams to spawn.[63] Some species prefer to spawn in very fast-moving water while others build their nests in pools and shallow riffles. Stream spawners scoop out a shallow depression in clean gravel, where the eggs are laid and fertilized. The eggs and very young fish remain in the nest, where the flowing water supplies oxygen necessary for them to survive. Eventually, they move downstream to lakes where they may spend several years before returning as adults to spawn. Initially, their food consists of small insects and other invertebrates, and later includes other fish.

The species which spawn in streams are dependent upon clear water with low sediment levels, cool temperatures, and high oxygen levels. Without these conditions, the eggs and young fish suffocate in the gravel nests. Activities which raise sedimentation or temperatures, or lower oxygen levels, could reduce or even destroy such fish populations.

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[61]FWS response to Subcommittees' questions. p. 13-A.

[62]FWS response to Subcommittees' questions. p. 13-A.

[63]For a detailed discussion of the biology of the sport fish found in the Yellowstone area, see individual species listings in: Scott, W. B. and E. J. Crossman. Freshwater Fishes of Canada. Ottawa, Fisheries Research Board of Canada, 1973.

DEVELOPMENT ACTIVITIES

This chapter addresses the economic consequences of various human development activities, as well as the interactions between those activities and the natural ecosystem and the possible conflicts among the activities. The activities examined include timber harvesting, water developments, grazing, energy and mineral development, and recreation. The following conclusions can be drawn about these activities from the information provided to the Subcommittees:

1. Recreation is the major economic activity on the Federal lands in the CGYR, followed by phosphate mining in the Caribou National Forest. In the National Forests, dispersed recreation (using primarily natural, scattered sites) accounts for more visitors, but has less impact on local jobs than developed recreation (using sites with Forest Service improvements).

2. The most important ecological impact of development activities in the CGYR is human access, frequently requiring building and use of roads. However, access, per se, is determined by independent decisions concerning each resource specialty, rather than as an integrated issue which is broadly considered for cumulative effects on the ecosystem.

3. The existing data available to Federal land managers is incomplete and inadequate, especially for recreation activities and for units of the National Park System.

4. The economic values used by the Forest Service for some activities (particularly recreation) appear to be essentially arbitrary, and management choices may be influenced by economic comparisons that do not reflect the relative importance of the activities.

OVERVIEW OF ECONOMIC IMPACTS

Numerous human activities in and around the CGYR can affect the ecosystem. Certain actions, especially at certain times or in specific locations, may radically alter the natural ecosystem, and perhaps even jeopardize the long-run ecological stability of the area. At the same time, many humans depend on those natural resources, and several communities depend on the area for their economic well-being. The human activities in the CGYR include: timber management, water developments, range management, energy and mineral development, recreation, and cultural and historic resource management. Before

these discussions, however, it is useful to examine some general measures of the local economic dependence on the CGYR.

Employment

More than 13,000 jobs are linked to the Federal lands in the CGYR. More than a third of these jobs directly depend on activities in the CGYR, while the remaining indirect and induced jobs are supported by the direct jobs.[64] Tables 7a and 7b shows the jobs created by activities in the National Forests in the CGYR for various categories of activities; similar information does not exist for other Federally managed lands.

The Forest Service estimates were derived from the agency's input-output model, IMPLAN. However, each National Forest modifies the model to account for local differences in the various industries. Thus, direct jobs from one Forest may be a somewhat different measure than from an adjacent Forest; the Bridger-Teton National Forest, for example, identified no jobs resulting from fishing, small game hunting, or other recreation, even though the Bridger-Teton accounted for more than half of the big game hunting and outfitter jobs in the CGYR. Nonetheless, the aggregate data provide a basis for some comparisons.

A brief perusal of the tables leads to several observations. (Details of jobs created by activities in the CGYR are included with the discussions of the various activities.) Energy and mineral development accounted for 42 percent of the jobs supported by the CGYR National Forests. However, most of this (4,800 jobs) is employment in the phosphate industry in and near the Caribou NF; the only other energy and mineral jobs were 80 oil and gas jobs in the Caribou and 818 indirect and induced jobs (but no direct jobs) from oil and gas activities in the Bridger-Teton. Recreation, in its various forms, supported another 42 percent of the jobs, including more than 1,500 jobs from fishing and hunting, more than 1,200 jobs from downhill skiing, and more than 2,800 jobs from other forms of recreation.

Payments to Counties

The Forest Service returns 25 percent of gross receipts from each National Forest to the counties within which the Forest is located. The funds are distributed according to the proportion of a Forest's acreage in each county, rather than to the specific counties where the

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[64]Direct jobs are generally those which occur on the Federal lands; indirect jobs are local jobs in industries which supply inputs for the direct jobs (such as jobs in a local feed store selling fencing to a rancher who grazes cattle on Federal lands), while induced jobs are those which result because the direct employees spend their money in the local community.

TABLE 7a. Direct Jobs From Activities in the CGYR National Forests
(* = less than 1 job; - = not reported)

	Fishing	Sm.Game Hunting	Big Game Hunting	Out-fitters	Downhill Skiing	Other Recreation	Grazing	Timber	Energy & Minerals	Total
Beaverhead NF	5	1	7	3	0	29	1	6	-	51
Gallatin NF	65	9	71	27	164	447	9	54	-	845
Custer NF	19	2	14	5	123	19	1	*	-	183
Shoshone NF	37	-	141	61	-	409	6	55	-	709
Bridger-Teton NF	-	-	332	135	116	-	69	86	-	739
Caribou NF	2	1	3	1	0	43	13	13	1,220	1,295
Targhee NF	20	2	38	21	306	656	44	285	-	1,374
Total CGYR	147	15	606	252	709	1,604	144	499	1,220	5,196

TABLE 7b. Indirect and Induced Jobs From the CGYR National Forests
(- = not reported)

	Fishing	Sm.Game Hunting	Big Game Hunting	Out-fitters	Downhill Skiing	Other Recreation	Grazing	Timber	Energy & Minerals	Total
Beaverhead NF	2	1	5	2	0	20	29	11	-	71
Gallatin NF	34	7	52	19	316	316	14	103	-	658
Custer NF	10	1	10	3	83	13	5	1	-	128
Shoshone NF	7	-	39	21	-	205	13	56	-	341
Bridger-Teton NF	-	-	226	35	28	-	284	104	818	1,494
Caribou NF	1	1	2	-	0	41	76	19	3,660	3,800
Targhee NF	19	2	34	6	280	659	262	520	-	1,782
Total CGYR	73	12	370	87	503	1,255	682	814	4,478	8,274

receipts are generated. The Forest Service reports only total payments for the National Forests; therefore, county payments associated with the CGYR must be estimated to allocate total payments for Forests and counties with National Forest lands both inside and outside the CGYR. The estimated Forest Service county payments associated with the CGYR averaged about $800,000 annually from 1982 through 1985. (The detailed procedures used to estimate these payments is presented in Appendix III.) The estimated payments exceeded $900,000 in 1985, and may be more typical, since 1982 and 1983 were particularly poor revenue years for the Forest Service.

In many circumstances, changes in Forest Service county payments would not affect total Federal payments to a county because of the Payments in Lieu of Taxes Act (PILT). Under this Act, the BLM generally pays counties $0.75 per acre for most types of Federal land (including National Forests). However, PILT payments are exactly offset by Forest Service county payments. PILT payments cannot fall below a minimum of $0.10 per acre, but will be reduced from the standard $0.75 per acre by Forest Service payments. Forest Service payments from the CGYR National Forests are low enough (the highest payments were $0.23 per acre from the Targhee NF in 1984) that changes are fully offset by corresponding changes in PILT payments to CGYR counties. Thus, it seems likely that the CGYR counties with National Forest land would be unaffected by any changes in Forest Service county payments.

TIMBER HARVESTING

The following section describes the Federal timber sale program, the jobs which result, and the effects of timber harvesting on other resources. The major findings are:

1. Timber access roads are the most significant impact on the ecosystem, by affecting water quality and increasing human activities (both the timber harvesting and other Forest visitors who use the roads).

2. Insect infestations of the timber are a major reason for harvests in the CGYR, and account for many, but not all, of the below-cost timber sales.

3. The seasonal timing of timber activities is important in assessing their impact on animals, but timing is typically ignored in determining the conditions for timber sales.

4. Cover -- dense stands of timber -- is important for many animals, especially grizzly bears, and activities that reduce timber stand density (such as thinning) can be harmful.

Federal Timber Management

Both the Forest Service and the BLM sell timber from their lands in the CGYR. Table 8 shows that more than 130 million board feet are harvested annually, with 99 percent of the total coming from the National Forests. More than half of the total is harvested from the Targhee NF, where timber salvage sales account for 98 percent of the timber harvest. Overall, 60 percent of the timber harvested from the Federal lands in the CGYR is from salvage sales.

TABLE 8. Average Timber Harvest from Federal Lands in the CGYR (in million board feet annually; n/r = not reported; * = than 5 MBF)
Forest Service = 1981-1985 average; BLM = 1976-1985 average

	Green Lodgepole	Douglas-fir	Spruce/ Fir	Dead/ Salvage	Annual Average	% of CGYR
Beaverhead NF	2.92	1.02	0.24	1.61	5.80	4.4%
Gallatin NF	8.29	3.19	2.28	5.88	19.64	14.8%
Custer NF	0.20	*	n/r	n/r	0.20	0.2%
Shoshone NF	6.12	0.11	0.04	4.08	10.36	7.8%
Bridger-Teton	18.48	.91	.76	n/r	20.15	15.2%
Caribou NF	2.03	2.87	.96	n/r	5.86	4.4%
Targhee NF	n/r	1.26	.08	68.13	69.46	52.3%
BLM - Idaho	.81	.03	n/r	n/r	.84	.6%
BLM - Montana	.11	.30	*	n/r	.42	.3%
BLM - Wyoming	n/r	.01	n/r	n/r	.01	< .1%
CGYR Total	38.40	9.71	4.38	79.69	132.74	
% of Total	28.9%	7.3%	3.3%	60.0%		

Salvage Sales

The majority of the timber harvesting in the CGYR is salvage of lodgepole pine infested with mountain pine beetles. These native insects have evolved a boom-and-bust cycle with lodgepole pine. The beetle populations reach epidemic proportions in mature pine stands, killing the majority of the trees in the stand; wildfire then sweeps through the stand, opening the lodgepole's serotinous cones to release the seeds and thereby regenerate the stand. Salvage timber harvests attempt to mimic this natural cycle, by clearcutting the trees while the wood is still usable, and regenerating the stand artificially. However, artificial regeneration is not always successful, and the roads and other human activities associated with timber harvesting have greater effects on water quality and animal populations than does the natural cycle.

Dead lodgepole or lodgepole salvage sales accounted for 60 percent of the timber sale program from the National Forests in the CGYR from FY81 through FY85. Salvage sales are heavily concentrated

in the Targhee NF, because of heavy insect infestations at the southeast corner of Yellowstone National Park. Map 2 identifies areas of intensive insect infestation (primarily, although not exclusively mountain pine beetles), as well as the areas harvested in the recent past and proposed for harvesting in the near future.

Timber harvesting is the only means currently used to control the beetles. Forestry research suggests that beetle problems can be controlled through (1) a discontinuous pattern of timber stands, (2) reduced average stand size and age, and (3) reduced stand density.[65] Salvage operations are generally not effective controls unless the harvest is within the first two years after the initial outbreak. Fire can also control beetle infestations, but only intense fires -- which would kill the trees -- kill the beetles. Finally, insecticides can be used, but it is difficult to reach the beetles under the tree bark, and the high cost and environmental effects of pesticides limit their usefulness.

The ability to control beetles through timber harvesting is limited. A long time is required to convert the extensive even-aged stands of mature lodgepole to younger, more vigorous, beetle-resistant stands. This conversion is further hampered by the poor economics of salvage operations. Salvage sales averaged gross returns of less than $10 per thousand board feet (MBF) from FY81 through FY85; this is substantially less than the Forest Service's direct cost to prepare and administer the sales. In addition, the lodgepole pine stands in the National Parks and in the wilderness areas are exempt from harvesting, and thus beetle populations can maintain themselves in these protected areas. Still, assuming insect control is desirable, the salvage sale program may be the least-cost means of controlling beetle epidemics and the subsequent devastating fires.

Commercial Sales

Non-salvage timber sales account for 40 percent of the Federal timber cut in the CGYR. Lodgepole pine dominates, accounting for 73 percent of the non-salvage volume harvested annually, although lodgepole accounts for only 57 percent of the commercial timberland in the CGYR. Lodgepole pine accounted for more than 90 percent of the timber harvested from the Bridger-Teton, Shoshone, and Custer National Forests, though it was less than two-thirds of the harvested volume from the Gallatin and Beaverhead. Douglas-fir accounts for much of the rest of the CGYR timber harvest, including more than 90 percent of the non-salvage timber harvested from the Targhee NF and nearly three-quarters of BLM timber harvested from the CGYR in Montana.

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[65] Amman, Gene D. and Les Safranyik. Insects of Lodgepole Pine: Impacts and Control. In Lodgepole Pine: The Species and Its Management. David M. Baumgartner, et al., eds. Pullman, WA, Washington State Univ., 1985. p. 117-120.

The harvest is not distributed evenly among the National Forests in the CGYR. Harvest levels on the Custer and the Caribou Forests are a smaller proportion of the CGYR total than would be expected from their acreage of commercial timberland; these Forests account for 0.2 percent and 4.4 percent of the average annual harvests, respectively, but contain 3.5 percent and 9.5 percent of the commercial timberland. The relatively small timber program on the Custer is likely the result of few mills and poor markets to the northeast of the CGYR. The relatively small timber program on the Caribou NF is likely due to the fact that 44 percent of the timberland is aspen (a non-commercial species in the CGYR). The timber programs on the Shoshone and Beaverhead Forests are greater than their share of commercial timberland would suggest; these Forests account for 7.8 percent and 4.4 percent of the annual harvest, respectively, but contain only 4.9 percent and 2.7 percent of the commercial timberland. Salvage sales account for nearly 40 percent of the Shoshone timber harvest, thus possibly explaining the relatively large timber program on the Shoshone.

Timber Sale Economics

Green lodgepole has brought the highest bid values for any timber species in the CGYR, averaging $23.55 per MBF cut, as shown in Table 9. However, the harvest values are highly variable, averaging $34.86 on the Gallatin National Forest, but only $14.82 on the Shoshone and under $10 on the Custer and on BLM lands in Montana. Differences in values result from variations in the quality and species mix on individual sales and in access and operating costs for the purchasers. The value of Douglas-fir harvested has averaged $20.26 per MBF, but shows even greater variability; Douglas-fir averaged $39.66 per MBF on the Bridger-Teton, but under $3 on the Shoshone and Targhee. The value of spruce and fir harvested in the CGYR has averaged only $16.28, and was higher than lodgepole pine and Douglas-fir on only the Caribou NF.

Not all timber harvest receipts are deposited in the U.S. Treasury. When reporting timber receipts, the Forest Service typically includes purchaser road credits; however, these credits are a grant of timber to the purchasers in exchange for specified road construction, and the Government neither receives nor expends cash. In addition, the Forest Service deposits some of the harvest receipts into the Timber Salvage and Knutson-Vandenberg (K-V) Funds. The Timber Salvage Fund is used to prepare and administer future salvage sales, while the K-V Fund is used for reforestation and other activities on the harvested areas. Finally, as noted earlier, the Forest Service returns 25 percent of gross timber sale receipts (excluding Timber Salvage Fund deposits) to the counties where the National Forest lands are located.

From FY83 through FY85, the special deposits and payments to counties due to timber harvests from the National Forest lands in the CGYR exceeded the receipts from the harvests, as shown in Table 10.

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TABLE 9. Average Value of Timber Harvested from Federal Lands in the CGYR
(in dollars per thousand board feet)
(Forest Service - 1981-1985 average, except Targhee NF - 1981-1983; BLM - 1976-1985 average; n/a - not applicable)

	Green Lodgepole	Douglas-fir	Spruce/ Fir	Dead/ Salvage	Annual Average
Beaverhead NF	$13.49	$28.26	$11.41	$ 4.35	$13.47
Gallatin NF	38.75	17.26	14.71	1.00	22.59
Custer NF	8.82	20.00	n/a	n/a	8.91
Shoshone NF	14.82	2.11	2.05	7.62	11.80
Bridger-Teton NF	23.83	39.66	18.95	n/a	24.37
Caribou NF	22.96	24.28	26.10	n/a	24.14
Targhee NF	n/a	2.64	1.00	9.42	9.36
BLM - Idaho	$10.62	$18.64	n/a	n/a	$10.86
BLM - Montana	9.40	11.93	$10.90	n/a	11.25
BLM - Wyoming	n/a	12.55	n/a	n/a	12.55
CGYR Total	$23.55	$20.26	$16.28	$ 8.61	$14.10

Gross receipts for FY83 through FY85 were $8.05 million, but this includes purchaser road credits of $2.24 million. Deposits for the three years to the Timber Salvage Fund totaled $1.03 million. K-V Fund deposits were estimated to be $3.88 million; this includes $2.38 million from the Gallatin, Custer, Shoshone, and Targhee NF, and an estimated $1.5 million from the Beaverhead, Bridger-Teton, and Caribou.[66] Finally, the Forest Service has paid the counties an estimated $1.75 million because of timber harvests in the CGYR. Thus, while $5.81 million was received from timber sales, $6.66 million was deposited in special timber funds or returned to the counties; the Forest Service used $0.85 million (nearly $300,000 annually) more than was received.

Timber sales also require expenditures by the Federal Government. From FY83 through FY85, the National Forests in the CGYR spent $8.96 million on timber sale preparation, administration, and support ($22.71 per MBF sold), and used $2.38 million from the K-V Fund ($6.05 per MBF sold).[67] This $11.34 million expended substantially exceeds the $5.81 million in cash receipts from timber sales during these

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[66]The latter 3 Forests did not distinguish K-V Fund deposits from other receipts. Their K-V Fund deposits have been estimated at the average ratio of deposits to receipts for the other 4 Forests; K-V Fund deposits equal 55% of gross receipts for the Gallatin, Custer, Shoshone, and Targhee Forests.

[67]It is sheer coincidence that the K-V Funds used by the Forests equal the K-V Fund deposits for the 4 Forests reporting their deposits.

TABLE 10. Timber Sale Receipts and Dispositions, FY83-FY85 Total

Gross receipts reported	$8.05 million
Less: Purchaser road credits	2.24 million
Cash receipts	$5.81 million
Dispositions of cash:	
Timber Salvage Fund deposits	$1.03 million
K-V Fund deposits - actual (4 Forests)	2.38 million
K-V Fund deposits - estimated (3 Forests)	1.5 million
Estimated payments to counties from timber sales	1.75 million
Sum of dispositions	$6.66 million
Cash receipts net of dispositions	-$0.85 million

three years; if payments to counties are included, the cash "loss" is even greater. The comparison of costs and cash dispositions with timber sale receipts is an important issue, because many groups have stated that lands where costs exceed receipts should be identified as not suited for timber production in the ongoing Forest Service land and resource management planning.

Economic Effects

The Forest Service reported that 499 direct jobs were created by timber harvesting in the CGYR, and another 813 were created indirectly or were induced by timber harvesting, as shown in Table 7. These estimates were derived from the agency's input-output model. However, depending on how each National Forest modified the model, direct jobs might be limited to jobs in timber harvesting on one Forest while another Forest might include and report jobs in milling and even in lumber distribution.

More than 50 sawmills receive Federal timber from the CGYR. Of these, only four mills have more than 100 employees (in St. Anthony, Idaho; Afton, Wyoming; and Livingston and Belgrade, Montana), while another 16 have between 10 and 100 employees. (Map 2 shows the locations of 17 of these sawmills; the mills in Idaho Falls, ID, Dillon, MT, and Evanston, WY, are beyond the borders of Map 2.) In total, the sawmills receiving Federal timber from the CGYR employ 1,065 people. Not all of these employees can be attributed to the CGYR, because numerous mills (especially in Montana) get some timber from outside the CGYR; for example, the two large mills in Montana get only a third of their timber from the CGYR.

Employment derived from timber harvesting in the CGYR can also be estimated from the timber harvest levels. In 1974, seven people were employed in the forest industry for each million board feet of timber

harvested in Idaho.[68] An average of 133 million board feet have been harvested annually from the Federal lands in the CGYR. This suggests that about 930 employees are supported by timber harvesting in the CGYR, assuming that sawmill labor intensity has not changed much since 1974. This figure roughly concurs with the employment in sawmills receiving CGYR timber.

In 1970, the timber industry accounted for less that 10 percent of the employment in the counties around CGYR.[69] Data from the Forest Service input-output model indicated that timber harvesting created 12.6 percent of the direct jobs resulting from activities on the National Forests, although 29.2 percent of the indirect and induced jobs resulted from timber harvesting. Thus, CGYR timber harvesting is an important source of employment, exceeding the jobs created by all other National Forest commodity outputs combined, except phosphate mining on the Caribou NF. However, recreation activities in the CGYR create substantially more direct, indirect, and induced jobs than all commodity outputs combined. (See Table 7, p. 41, and Economic Effects under Recreation, p. 95.)

Effects on Other Resources

Effects on Water and Watersheds

Timber harvesting can alter water flows and watershed values, and the runoff from the CGYR is important for several major rivers. Forests have long been recognized as valuable for protecting watersheds,[70] largely by regulating water run-off and preventing erosion. Snow accumulation is greater in clearcuts than in surrounding forested areas (because of wind-blown snowdrifts and lower evapo-transpiration rates), and the openings increase melt rates and peak runoff. Thus, timber harvesting generally increases spring flows and flood potential, while decreasing summer streamflow.[71]

A more important watershed concern may be the potential water pollution from increased erosion following timber harvesting. Erosion from harvested sites is of some concern, but it is widely recognized that the erosion from roads associated with timber harvesting is

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[68]Bell, Enoch F. Estimating Effect of Timber Harvesting Levels on Employment in Western United States. Forest Service Research Note INT-237. Ogden, UT, U.S. Dept. of Agriculture, Nov. 1977. p. 4.

[69]Bell, Estimating Timber Employment. p. 3.

[70]Lotan, James E. and David A. Perry. Ecology and Regeneration of Lodgepole Pine. Agriculture Handbook No. 606. Washington, U.S. Govt. Print. Off., March 1983. p. 2.

[71]Fahey, Timothy J. and Dennis H. Knight. Lodgepole Pine Ecosystems. Bioscience, v. 36, no. 9 (Oct. 1986): 610-617.

generally far more damaging to water quality. A Forest Service research report on lodgepole pine management for the control of mountain pine beetles stated:[72]

> The primary watershed concerns with epidemics thus appear to be the potential for lowering water quality through sedimentation from roads constructed to salvage timber.

Increased sedimentation can be a particular problem for downstream users who depend on clean water, as well as for fish and wildlife.

Effects on Fish and Wildlife

Access. The road construction which nearly always accompanies timber harvesting can be beneficial or harmful to fish and wildlife populations, depending on the road locations and use. Roads can have both direct impacts, by increasing erosion and creating open corridors through the forest, and indirect impacts, by increasing the numbers of people present in the area. The roads and the access they provide can affect fish and wildlife populations in various, interrelated ways.

The Idaho Department of Fish and Game stated that additional roads would make big game (particularly elk) more vulnerable, and that this would require the Department to shorten the hunting season or to reduce the number of hunters or the elk harvest in some other way.[73] However, from the agencies' responses provided to the Subcommittees, it is impossible to determine whether similar damage is occurring in other parts of the CGYR or for other species, and whether the benefits of increased access may be greater than the damage.

Increased access is harmful to grizzly bears, because most bears avoid human contact whenever possible. Since access is necessary for timber harvesting, timber cutting restricts bear habitat and can alter bear behavior. A greater reliance on temporary timber roads (roads which are permanently closed to travel after timber removal is completed) can reduce the long-term impact of road construction.

The timing of the timber cutting and removal can influence the impact of roads on grizzlies. Access can be timed so as to avoid prime bear use areas when the bears are there, such as den sites

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[72]McGregor, Mark D. Soil and Water Quality. In Integrating Management Strategies for the Mountain Pine Beetle with Multiple-Resource Management of Lodgepole Pine Forests. Forest Service General Technical Report INT-174. Ogden, UT, U.S. Dept. of Agriculture, April 1985. p. 44.

[73]Idaho Department of Fish and Game response to the Subcommittees' questions. p. 2.

during winter or stands near clover meadows when the clover is blooming. This level of control on timber harvest timing requires greater knowledge and understanding of grizzly habits, but is rarely used in current timber harvesting contracts. However, such measures might allow timber harvesting over a greater area with minor impacts on grizzly bears. Greater control is probably most important in areas with substantial grizzly bear use. Several sales have been proposed in areas with heavy grizzly use (as identified in Figure 4, p. 24), including two sales in the Gallatin National Forest (north of West Yellowstone and east of Cooke City) and some in the Shoshone (on Sunlight Creek and along the Clark's Fork of the Yellowstone River).

Control over the timing of access could also probably reduce the effects of timber harvesting on birds, particularly bald eagles and peregrine falcons. Avoiding the disturbance caused by timber activities during the nesting season would likely enhance the reproductive success for these endangered birds, with minimal impacts on timber harvesting, providing that the nest trees are left standing. Again, current timber harvesting contracts do not typically include such timing restrictions for wildlife protection.

Habitat. In addition to the effects of increased access, the cutting of trees can directly affect fish and wildlife habitats. Fish can be affected by stream sedimentation -- particularly from roads constructed for timber removal -- and by the loss of shade which can raise stream temperatures above tolerable levels.[74] The effects of timber harvesting on fish habitat can be minimized by protecting riparian areas and with careful road engineering to minimize sedimentation.

Protecting fish habitat in the CGYR is critical, since fish are important food sources for other animals, such as grizzlies and bald eagles. In addition, the wetlands and riparian areas that are important for fish are also favored habitats for bald eagles, trumpeter swans, whooping cranes, and moose. Thus, the importance of protecting these areas goes beyond the direct benefits to sport anglers.

Timber harvesting can improve the abundance and the distribution of forage for elk, deer, and grizzly bears.[75] Timber harvesting typically increases succulent herbaceous plant growth, and timber management that emphasizes the retention of whitebark pine (a minor

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[74]McGregor, Soil and Water Quality. p. 44.

[75]Light, Jerome T. and William B. Burbridge. Effects of Outbreaks and Management Responses on Big Game and Other Wildlife. In Integrating Management Strategies for the Mountain Pine Beetle with Multiple-Resource Management of Lodgepole Pine Forests. Forest Service General Technical Report INT-174. Ogden, UT, U.S. Dept. of Agriculture, April 1985. pp. 37-43.

species of low commercial value) can provide pine nuts for grizzlies. However, any benefits to big game from increases in forage after timber harvesting are limited to the summer, because snow accumulations in clearcuts restrict winter forage availability. Light and Burbridge noted that:[76]

> Forage in clearcut openings during winter is usually unavailable to big game due to deep-crusted snow. On elk and deer winter range where winds do not influence snow depth, clearcutting in response to beetle epidemics generally results in loss of cover and no gains in available forage.

Thus, timber harvesting can benefit wildlife species where summer forage is a limiting factor; however, if winter habitat, for example, is the limiting factor, timber harvesting in the CGYR will likely yield no benefits for the species.

Cover is recognized as a significant component of habitat. Timber harvesting generally reduces the amount of cover, while intermediate stand treatments, such as thinning, often reduce the cover density. The Forest Service has considered 40 percent of an area remaining in cover to be optimal for summer elk habitat, but the Idaho Department of Fish and Game has stated that 40 percent should be considered a minimum, rather than an optimum.[77] Cover is particularly important around elk calving grounds; such areas, which tend to be used in successive seasons, could be protected with little impact on the timber harvest by avoiding harvests near calving grounds.

For grizzly bears, cover is important for daybed resting sites, particularly near forage areas. The lack of dense cover around potential foraging sites, whether natural meadows or feeding areas enhanced by human actions, may limit foraging activities of the bears. Dense cover can be maintained by avoiding timber activities around foraging sites.

Perching and nest trees are important for bald eagles and peregrine falcons. The preferred trees are large snags (dead, bare trees), particularly near favored fishing areas. Leaving, or even creating, snags could be beneficial for these species. Harvesting can probably occur quite close to nest trees without affecting the birds, as long as nesting seasons are avoided.

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[76]Ibid. p. 39.

[77]Idaho Department of Fish and Game. Letter to John E. Burns, Targhee National Forest Supervisor, March 15, 1982. p. 5.

Effects on Recreation

Access. New roads can be beneficial for some types of recreation activities and harmful for others, depending on the road locations and use. Additional roads generally increase access, and are typically beneficial for activities which occur along roads (picnicking, fishing, hunting, some sightseeing, etc.). On the other hand, increased access may devalue an area for recreation associated with roadless areas, such as backpacking. It is difficult to determine whether the benefits for some users of increased access from additional road construction exceed the harm to other recreationists who prefer fewer roads.

Aesthetics. A timber harvest site is not particularly beautiful, but extensive stands of dead or dying lodgepole pine, such as an area with a mountain pine beetle epidemic, may not be any better from an aesthetic viewpoint. Timber salvage operations can improve aesthetics, if the dead trees are replaced by healthy ones. However, harvesting can also aggravate the aesthetic problems; Forest Service research reports that:[78]

> From a visual perspective, the more rapidly the dead lodgepole pine is replaced with healthy vegetation, the better; however, if cutting methods selected for natural regeneration or to minimize losses [from mountain pine beetles] are visually more undesirable than the effect of standing and fallen dead timber, the visual discontinuity of the landscape will have been aggravated or even magnified instead of lessened.

The current Forest Service visual management objectives and criteria may be sufficient to adequately protect the exceptional aesthetics of the CGYR, particularly if the most restrictive criteria are applied to the travel corridors bringing tourists into Yellowstone and Grand Teton National Parks. However, if second homes on the private lands scattered along the lower elevations remain or proliferate, the interests of the homeowners could conflict with timber harvesting. If the homeowners, resort owners, and permittees organize into an effective interest group, the Forest Service could have difficulty in continuing current timber harvesting programs.

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[78]McGregor, Mark D. Landscape and Visual Management Concerns. In Integrating Management Strategies for the Mountain Pine Beetle with Multiple-Resource Management of Lodgepole Pine Forests. Forest Service General Technical Report INT-174. Ogden, UT, U.S. Dept. of Agriculture, April 1985. p. 44.

Effects on Range Management

Timber harvesting can be beneficial for range management. Dense, mature timber stands produce little forage, but clearcutting can yield significant quantities of forage for several years.[79] The forage produced by timber harvesting is beneficial for grazing, because livestock are more tolerant of human presence and cover is less important for livestock than for wildlife, and because the National Forests are grazed primarily during the summer, when the areas are clear of snow. At times, timber harvesting can conflict with range management, when both activities occur on the same or adjacent sites simultaneously. However, some control of the timing of harvesting and of livestock use can minimize such conflicts.

Effects on Energy and Mineral Development

Timber harvesting has little impact on energy and mineral development. The road construction often associated with timber harvesting could be beneficial for energy and mineral exploration and development by providing access to previously roadless areas, particularly since the Forest Service would then bear the costs of road development and maintenance. However, timber harvesting can at times conflict with energy and mineral activities, when both activities occur on the same or adjacent sites simultaneously. Some control of the timing of harvesting and of exploration and development of energy or minerals can minimize such conflicts.

WATER DEVELOPMENTS

This section describes the water development proposals in the CGYR, and describes the effects of three types of projects on other resources. The conclusions about water developments are:

1. There are many Federal agencies (at least ten) involved in various types and aspects of water developments, with little coordination among them.

2. Water projects can eliminate riparian areas, which are critical habitats for many animals, and harm cutthroat trout populations, on which several other animals depend.

Federal Water Projects

Water management in the CGYR (as well as elsewhere) is a complicated issue. States generally have jurisdiction over water rights, although certain Federal laws reserve some water rights in particular

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[79]Lotan and Perry, Ecology of Lodgepole Pine. p. 2.

areas to the Federal Government. Two Federal agencies -- the Bureau of Reclamation (BuRec) and the Army Corps of Engineers -- construct most Federal water projects, although the Federal Energy Regulatory Commission (FERC) regulates hydropower developments and the Environmental Protection Agency and/or the Army Corps of Engineers review proposals for water projects on Federal lands. In addition, the Federal land managing agencies -- principally the Forest Service, National Park Service, and Fish and Wildlife Service -- are responsible for maintaining adequate water quality in the lakes and rivers flowing through their lands. This amalgam of Federal agencies makes for complex water management arrangements in the CGYR.

Federal Energy Regulatory Commission

There are numerous proposed and licensed water projects throughout the CGYR (Map 5), with the Federal Energy Regulatory Commission (FERC) overseeing the permitting and licensing for major hydropower projects. In response to a request for a license, FERC issues a preliminary permit authorizing three years' access to a site for a feasibility study. The permit holder can then file for a license to build and operate a facility. Licensing requires a public hearing on the project, among other actions. Certain projects (such as those with a generating capacity less than five megawatts) are exempt from the full licensing process and can receive operation authority more quickly.[80]

There are 14 projects in various stages of FERC permitting and licensing within the CGYR (Map 5). FERC has issued permits for four projects north and northwest of Yellowstone Park, in the Gallatin and Beaverhead Forests; one exemption (for a project of less than five megawatts) has also been applied for in this area. There are four FERC projects on private lands in Paradise Valley along the Yellowstone River north of the Park. A permit has been requested for a hydropower facility at the Island Park Dam, west of Yellowstone.[81] The other four projects are south of Yellowstone. One is a permit for a hydropower feasibility study for the Jackson Lake Dam in Grand Teton National Park,[82] while another is a preliminary permit for a hydropower facility on private land between the National Elk Refuge and the Bridger-Teton National Forest. The other two permits are for National Forest land, on Greys River in the Bridger-Teton and on Fall Creek in the Caribou, near Swan Valley (below Palisades Dam).

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[80]Personal communication with Paul McKee, Federal Energy Regulatory Commission. September 11, 1986.

[81]Bureau of Reclamation response to Subcommittees' questions.

[82]FERC response to Subcommittee's questions. (by map).

Bureau of Reclamation

Most of the Federal water projects in the CGYR have been constructed by the Bureau of Reclamation (BuRec). BuRec is currently considering upgrading the hydroelectric generating capacity of Palisades Dam by rewinding existing generators and using some of the water presently being spilled.[83] This change would not require any additional permits, and the power generated would be marketed by the Bonneville Power Administration. BuRec did not provide any information about the potential effects of this upgrade on the reservoir or on the Snake River below the dam.

BuRec also identified two proposed future developments in the CGYR.[84] One, on the Madison River in Montana, includes developments that would irrigate 12,600 acres with water diverted from the river. The other plan is to develop the power potential of the Clarks Fork of the Yellowstone River, in the Shoshone National Forest, with three dams and reservoirs on the main stream and one on Sunlight Creek. This plan was presented to Congress in 1944,[85] but the project has never been authorized or funded. Sunlight Creek is one of the areas identified as a concentration of grizzly bear deaths. (See Grizzly Bear Mortality Clusters, below.)

Other Water Projects

A number of water projects (which do not require FERC permits or licenses) are pending in Wyoming. The Wind River Indian Tribes and the State of Wyoming are discussing enlarging two reservoirs on the Wind River Reservation: Raft Lake and Bull Lake.[86] However, the extent of the tribes' reserved water rights in Fremont County must be settled before either project can be undertaken.

The Army Corps of Engineers has limited activity within the CGYR. Among other things, the Corps occasionally modifies stream channels to control possible flooding. In some areas, this includes "channelization", whereby artificial stream channels are constructed to direct

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[83]Bureau of Reclamation response to Subcommittees' questions.

[84]BuRec response to Subcommittees' questions.

[85]U.S. Congress. Senate. Missouri River Basin: Conservation, Control, and Use of Water Resources of the Missouri River Basin in Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Missouri. (Report by Secretary of the Interior Harold L. Ickes on Bureau of Reclamation's Plan for Basin Development.) Document No. 191, 78th Congress, 2d Session. Washington, U.S. Govt. Print. Off., 1944. p. 48.

[86]Bull Lake is not in the CGYR, but it adjoins the area and its watershed is entirely within the CGYR.

the flow of water, but no channelization has occurred or been proposed for the CGYR. The Corps also uses levees to contain streamflows in limited areas. In the late 1940s, the Corps built levees along about 11 miles of the Snake River, between Grand Teton Park and the Bridger-Teton National Forest, to protect the valley from flooding. The Corps is responsible for annual inspections and emergency repairs on these flood control levees.[87]

There are numerous, small water projects on the National Forests, mostly wells, springs or irrigation diversions; the number of such projects ranges from 16 on the Caribou NF to 62 on the Targhee, although not all Forests reported the number of water projects in the CGYR.[88] The only reported water development proposal in the National Forests is the reconstruction of the Fremont Lake Dam on the Bridger-Teton NF near Pinedale, Wyoming.[89]

Dams and hydropower projects are not the only water developments in the CGYR. The U.S. Geological Survey has studied the effects of wastewater effluent discharge in the two National Parks, including three effluent sites in Grand Teton and four sewage lagoons in Yellowstone (at Fishing Bridge, Madison Junction, Old Faithful, and Grant Village); the latter study, conducted cooperatively with the National Park Service, included continued monitoring of the effects of effluent discharges on the lakes and streams of the area.[90]

Economic Effects

Direct jobs resulting from Federal water developments in the CGYR were not identified by any of the agencies responding to the Subcommittees' questions. It seems likely that Federal water developments provide few permanent jobs, compared with the other activities occurring on Federal lands in the CGYR, because of the relatively small size of the existing projects and the few proposals for new developments.

The water diverted by Federal water developments is primarily used to irrigate the dry plains surrounding the Yellowstone ecosystem. Water is essential for the ranchers and farmers in the vicinity, although no information was provided to determine the degree of local dependence on Federal water projects. However, the CGYR contains the headwaters of several streams and rivers of significance both locally and throughout the West. Receipts from irrigation water are low, and

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[87]Army Corps of Engineers response to Subcommittees' questions.

[88]Forest Service responses to Subcommittees' questions.

[89]National Forest Service response to Subcommittees' questions.

[90]USGS response to Subcommittees' questions. pp. 81, 83.

are generally substantially below the Federal costs for building reservoirs.[91]

Flood control is another economic benefit from many Federal water projects. Water developments allow some control over the quantity and timing of streamflow, and thus the project managers can often reduce the likelihood of devastating floods. However, it is difficult to estimate the economic benefits of preventing rare but devastating events, and no current estimates were made by the agencies for the developments in the CGYR. In addition, the agencies did not identify those projects which have significant flood control benefits.

Finally, the FERC-authorized projects in the CGYR generate electricity. Some of the electricity is probably used locally, although the distribution of power from these developments was not reported by FERC or the other Federal agencies. The BuRec stated that electricity from the upgrade of the hydroelectric facilities at Palisades Dam would be sold in the Pacific Northwest through the Bonneville Power Administration.[92]

Effects on Other Resources

It is difficult to assess the effects of water developments on other resources and users, because of the substantial variation among the projects. Some projects, such as major reservoirs with hydroelectric facilities, may alter many uses over a wide area, while others, such as spring development, may have only minor effects. To facilitate this discussion, three distinct (although related) aspects of water developments are examined separately: water impoundments (lakes and reservoirs); hydroelectric facilities and associated power delivery systems; and stream channel projects.

Water Impoundments

Dams, which convert free-flowing streams into reservoirs, can cause significant alterations to resources and uses of an area. Fish dependent on streams may be replaced by other species which prefer lakes; the habitat of wildlife which depend on stream-living fish, such as grizzly bears and bald eagles, will in turn be lost through flooding. Dams also impede fish migrations within watersheds, and thus the effects may exceed the loss of stream habitat. Similarly, recreation activities will be changed, with lake-(and boat-) based fishing replacing such activities as stream fishing and river rafting. In addition, some recreation facilities, such as campgrounds and

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[91]Frederick, Kenneth D. Water Supplies. In Current Issues in Natural Resource Policy. Paul R. Portney, ed. Washington, Resources for the Future, 1982. pp. 243-246.

[92]BuRec response to Subcommittees' questions.

picnic areas, might be flooded by the reservoir. Finally, commercial activities would be affected on the lands inundated by the reservoir.

There are no new reservoirs imminent for the CGYR. (The BuRec's plans for the Clarks Fork have not been authorized.) However, several proposals might increase the height of existing dams, thus expanding their reservoirs. A comprehensive list of proposed increases in existing dams is not available. The most important immediate effect of expanding a reservoir is the loss of land and its riparian vegetation along the shore. Many animal species of the Yellowstone ecosystem depend on these riparian areas, including bald eagles, trumpeter swans, whooping cranes, as well as moose and grizzly bears. Recovery of the riparian areas may require a decade or more, depending on the stability of the new shoreline. In extreme cases, where shore erosion is severe, riparian vegetation might never be reestablished. Without specific information on proposed dam enlargements, however, the possible effects cannot be examined in detail.

Another possible impact of reservoir expansion is the loss of upstream areas for fish spawning. Several important fish species of the lakes and reservoirs of the CGYR, such as cutthroat trout, spawn in the streams above the lakes. Some dam enlargements would inundate spawning streams; for example, the FWS estimated that raising the Middle Creek Dam (on Hyalite Creek in the Gallatin National Forest) by 10 feet would eliminate half of the cutthroat trout spawning habitat and more than three-quarters of grayling spawning habitat.[93] The natural spawning runs are important to grizzly bears and bald eagles in addition to providing sport fishing without cost to the Government.

Control of water flow through the dams can be managed to minimize the loss of stream habitat. BuRec stated that their activities directly benefit wildlife in the streams below Island Park and Palisades Dams. Increased releases from Island Park Reservoir provide more open water for trumpeter swans wintering along Henry's Fork of the Snake River, while releases from Palisades Reservoir are increased during goose nesting season to ensure that nests will be high enough to be protected from summer irrigation releases.[94]

Hydroelectric Facilities

Hydroelectric facilities generally have little direct impact on animals or on other resource users. However, new or substantially increased hydroelectric projects may increase human traffic in travel corridors to and from the site and in the area around the dam. In

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[93]FWS response to Subcommittees' questions. Attachment 11, p. 3. (Original is letter from John G. Wood, U.S. Fish and Wildlife Service, Billings, MT, to John J. Dolan, Bozeman District Ranger, Gallatin National Forest, Bozeman, MT, on December 13, 1985.)

[94]BuRec responses to Subcommittees' questions.

addition, the power line corridors used to deliver the electricity may increase access, particularly for all-terrain vehicles (4-wheel drives, snowmobiles, etc.). (See Access under Timber Harvesting, p. 49.) Generally, increased access is harmful to grizzly bears, because they avoid human contact; however, only one FERC-authorized project (east of Gardiner, near the Yellowstone Park boundary) is in a high-use area for grizzlies (as identified in Figure 4, p. 24). For other wildlife and fish species, the effects depend primarily on the possible erosion and stream sedimentation during the construction and from the power line corridors and access roads.

Stream Channel Projects

The effect of levees for controlling streamflow on other resources depends on the location of the levees. If the area enclosed by levees includes most of the riparian zone, this important wildlife habitat would generally be protected from development activities. This would also protect the majority of the natural floodplain, thus reducing the potential for downstream flooding. Some of the levees along the Snake River, below Irwin, Idaho, have yielded these benefits by protecting a wide cottonwood riparian zone.[95]

On the other hand, the levees built close to stream channels may substantially restrict the streamcourse. This could eliminate some riparian areas, alter the stream character (perhaps affecting the fish habitat), increasing downstream flooding, and bringing human developments and access closer to the riparian zones (perhaps impinging on wildlife). In addition, levees may encourage development on floodplains, thus increasing local economic losses during severe floods.

The GYE Bald Eagle Working Team stated that the streamflow regulation along the Snake River has degraded the River's fisheries. In the past, control of waterflow led to lateral erosion and channel expansion. The levees, built to reduce lateral erosion and flooding, increased channelization and the velocity of water in the Snake River. According to the GYE Bald Eagle Working Team, these changes have had the following results:[96]

1. Trout habitat is degraded. In-river spawning habitat is practically eliminated and spawning is restricted to feeder streams;
2. Shallows and riffles used by eagles to obtain prey are reduced;
3. Islands that have trees adequate for nests are being eliminated.

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[95]A Bald Eagle Management Plan for the Greater Yellowstone Ecosystem. November, 1983. GYE Bald Eagle Working Team. Published by Wyoming Game and Fish Department. p. 28.

[96]GYE Bald Eagle Working Team. p. 23.

4. Conditions conducive to cottonwood regeneration have been eliminated by preventing the flooding and scouring action of the river in adjacent flood plains.

Even more damaging to bald eagles, in the Team's opinion, was the increased housing development following levee construction.

GRAZING

This section describes grazing on Federal rangelands in the CGYR, the jobs which result, and the effects of grazing on other resources in the area. There are several major findings.

1. Grazing on Federal rangelands in the CGYR supports little direct employment, although there are secondary effects (indirect and induced jobs).

2. Grazing requires Federal cash expenditures substantially greater than the resulting revenues.

3. Livestock can damage riparian (stream- and lake-side) areas, which are critical habitats for many animal species.

4. Sheep grazing in areas with moderate or higher grizzly bear densities may result in unnecessary conflicts between humans and bears.

Range Management

Commercial grazing is allowed in the National Forests, on BLM lands, and in some National Wildlife Refuges (including Red Rocks Lake NWR in the CGYR). The CGYR contains more than 2.6 million acres where commercial grazing is allowed, as shown in Table 11. Under the regulations of the administering agency,[97] ranchers obtain grazing permits, which authorize them to graze a specified number of animals, during a specified period, in a specified area (known as an allotment). The permittee pays a grazing fee for the permitted amount of use, based on an animal unit month. (The amount of forage a cow and calf consume in one month is called an Animal Unit Month - or AUM.) Theoretically, the permits must be renewed annually, and the Forest Service has the authority to alter or revoke a permit. Changes are rare, however, because Forest Service policy generally favors continuing permits to maintain the status quo.

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[97]BLM and Forest Service regulations differ substantially; this discussion only describes Forest Service grazing permits, since they account for 95 percent of the grazing use on Federal lands in the CGYR.

Commercial grazing is authorized in some National Parks, although none in the CGYR. The National Park Service Organic Act of 1916 authorized commercial grazing in the National Park System, as long as grazing did not conflict with recreation in the Parks. However, during the debate, several Members of Congress expressed concerns that commercial grazing in Yellowstone would destroy its value as a wildlife sanctuary. Thus, a provision prohibiting commercial grazing in Yellowstone National Park was included in the 1916 Act. Today, commercial grazing is prohibited in most National Parks and Monuments (including all Park System lands in the CGYR), although it is authorized in at least 20 of the 337 units of the National Park System.[98]

TABLE 11. Grazing on Federal Lands in the CGYR During 1985
(in thousands of acres and thousands of AUMs)
* = average animals lost, 1981-1985; [ ] = actual use substituted for unreported permitted use; e = estimated; n/r = not reported; a = as reported

	Cattle Grazing			Sheep Grazing			*Annual
		Permitted	Actual		Permitted	Actual	Livestock
	Acres	Use	Use	Acres	Use	Use	Losses
Beaverhead	104.3	[38.8]	38.8	26.1	[1.0]	1.0	39
Gallatin	102.6	29.5	26.7	9.7	0.6	0.5	72
Custer	55.5	8.3	7.8	0.0	0.0	0.0	0
Shoshone	250.3	73.4	65.3	47.8	1.7	0.6	245
Br.-Teton	541.8	195.7	171.5	321.5	13.9	12.5	3,540
Caribou	114.0e	[19.4]	19.4	169.0e	[5.7]	5.7	1,878
Targhee	389.6	52.1	53.7 a	371.8	11.9	7.2	1,552
Idaho BLM	17.5	[4.0]	4.0	1.3	[0.2]	0.2	n/r
Montana BLM	26.3e	[7.7]	7.7	2.7e	[0.1]	0.1	n/r
Wyoming BLM	14.8e	[5.0]	5.0	45.9e	[1.9]	1.9	n/r
Red Rock Lakes NWR	16.2e	[5.5]	5.5	0.0	0.0	0.0	n/r
CGYR Total	1,632.9	438.4	405.4	995.9	37.2	29.7	7,325

Cattle Grazing

Cattle grazing is permitted on more than 1.6 million acres (about 12 percent) of Federal land in the CGYR; this is more than 60 percent of the Federal grazing lands, as shown in Table 11, with sheep grazing on the other 40 percent of Federal grazing lands. More than a third of the cattle grazing allotment acreage is in the Bridger-Teton National Forest, although all of the National Forests in the CGYR contain one or more cattle allotments. For much of the CGYR, about

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[98]Personal communication with William Halainen, National Park Service, Washington, DC. Oct. 6, 1986.

three acres are required to support a cow and calf for one month, although conditions vary -- more than seven acres are needed per AUM in the Targhee NF. Nearly 400,000 AUMs of cattle were grazed on the CGYR National Forests in the 1985 grazing season,[99] with nearly another 20,000 AUMs on BLM lands and 5,500 AUMs in Red Rock Lakes NWR. The actual use was about 92 percent of the permitted level in the CGYR, varying from 88 percent on the Bridger-Teton NF to 103 percent on the Targhee.

Cattle are grazers, eating primarily grass when it is available; thus, cattle compete directly with wildlife which graze - principally elk and bison in the CGYR. Cattle are typically turned loose, and allowed to roam freely throughout the allotment. The permittees are responsible for maintaining the fences and other improvements, and for transporting the cattle to and from the allotment, but permittees do not continually supervise their cattle.

One might expect that the relatively low level of protection would lead to substantial losses of cattle to predators or poisonous plants. Forest Service data on livestock losses do not distinguish cattle losses from sheep losses. However, the statistically significant correlation between livestock losses and cattle and sheep grazing indicates that fewer than one percent of cattle grazing in the CGYR are lost annually, while about five percent of sheep are lost. Thus, there appears to be little cause for concern over potential cattle losses in the CGYR.

Sheep Grazing

Sheep (and goat) grazing is permitted on nearly 1.0 million acres of Federal rangelands, nearly 40 percent of the Federal grazing land in the CGYR. The sheep allotments are concentrated to the south and west of Yellowstone National Park, on the Bridger-Teton, Targhee, and Caribou National Forests, as shown in Table 11. For most of the CGYR, about five acres are required to support a ewe and lamb for one month.[100] More than 30,000 AUMs were grazed in CGYR National Forests in the 1985 grazing season, with another 2,500 AUMs of sheep on BLM lands in the CGYR. The actual use was only 82 percent of the permitted level; use was at 90 percent of the permitted level on the Bridger-Teton NF, but only at 61 percent on the Targhee.

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[99]Grazing seasons in the National Forests are generally during the summer months, although the seasons vary substantially among the Forests.

[100]Sheep require less forage than cattle; 5 ewes with lambs equal 1 AUM. However, sheep allotments in the CGYR contain much less forage than the cattle allotments, and thus about 25 acres are required per sheep AUM.

Sheep are browsers, eating predominately herbs and shrubs; they compete directly with wildlife browsers, such as deer and moose. Sheep can be a serious problem in competition for forage, because they browse close to the ground, leaving little food available for other animals. Nearly continual movement is necessary to prevent sheep from overgrazing an area, and thus sheep are typically accompanied by herders, rather than turned loose in the allotment. This greater protection should lead to lower losses of sheep to predators, poisonous plants, and other factors. However, the correlation of livestock losses with cattle and sheep use indicates that about five percent of the sheep are lost annually. Half of all livestock losses in the past five years are due to predators; the primary predators are probably coyotes, but some livestock (less than one percent of predator losses) has been lost to grizzlies.

Range Management Economics

The grazing fee for nearly all Federal rangelands was $1.35 per AUM in 1985. Using this fee, receipts from grazing on the Federal lands of the CGYR in 1985 were calculated to be $580,000. However, not all grazing receipts are available for the U.S. Treasury. As noted earlier, the Forest Service returns 25 percent of its gross receipts to the counties where the National Forests are located (calculated to be $136,100); the BLM generally returns 12.5 percent of its gross grazing receipts to the counties (calculated to be $3,200). In addition, half of grazing receipts from each agency are deposited in a Range Betterment Fund (calculated to be $285,000), which are subsequently appropriated to each agency for rangeland improvements. Thus, only about $155,700 from 1985 grazing receipts was available to cover Forest Service and BLM range management costs.

It seems likely that the range management costs exceed the net grazing receipts from the CGYR. Gross Forest Service grazing receipts nationwide in 1985 were $9.0 million, compared to FY85 appropriations for range management of $28.2 million.[101] Similarly, gross BLM grazing receipts nationwide in 1985 were $14.8 million, while appropriations for range management were $48.0 million.[102] Thus, gross grazing receipts accounted for less than a third of appropriations nationally in FY85. Because grazing fees are the same on nearly all

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[101]U.S. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies. Hearings, Part 2: Justification of the Budget Estimates. 99th Congress, 1st Session. Washington, U.S. Govt. Print. Off., 1985. pp. 1154, 1324.

[102]U.S. Congress. House. Committee on Appropriations. Subcommittee on Department of the Interior and Related Agencies. Hearings, Part 1: Justification of the Budget Estimates. 99th Congress, 1st Session. Washington, U.S. Govt. Print. Off., 1985. pp. 14, 83.

Federal lands, it is probable that the Forest Service and BLM net grazing receipts (after payments to counties and range improvement deposits) are substantially less than range management costs in the CGYR.

The Forest Service identified grazing fees on private lands near the National Forests in the CGYR.[103] The private land grazing fees ranged from $7 per AUM near the Hebgen Lake District of the Gallatin NF to $12.50 on the adjoining Bozeman District; the grazing fees on private lands averaged about $10 per AUM. The Federal grazing fee of $1.35 per AUM is more than 80 percent below the reported private grazing fees in the CGYR. Private fees would be expected to be higher than fees for Federal rangelands, because of such factors as permit conditions (both physical and financial) and differences in operating costs, but competitive prices for leases of Federal lands (on those few places where they occur) are only 15 percent below comparable private grazing fees.[104] Thus, grazing on Federal lands occurs for fees which are substantially below the private market value of the grazing, and which do not cover the range management costs of the agencies.

Economic Effects

The Forest Service reported that 144 direct jobs were created by livestock grazing in the National Forests of the CGYR,[105] only 3.6 percent of the total number of all types of jobs created directly by activities in the CGYR National Forests. In addition, another 681 jobs were created indirectly or were induced by livestock grazing. These estimates were derived from the agency's input-output model; however, each Forest modifies the model to its own circumstances, and thus the "jobs created" estimates may not use the same basis on all Forests, and may not be very comparable to other industries.

As noted above, the Forest Service returns 25 percent of its gross receipts to the counties where the National Forests are located. For grazing, this is calculated to be $136,100 for FY86 (based on 1985 receipts), less than 15 percent of the total 1985 Forest Service payments to those counties. BLM payments to counties for FY86 from grazing were calculated to be only $3,200.

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[103]Forest Service responses to Subcommittees' question 10.

[104]U.S. Department of Agriculture, Forest Service and Department of the Interior, Bureau of Land Management. Grazing Fee Review and Evaluation: A Report From the Secretary of Agriculture and the Secretary of the Interior. Washington, U.S. Govt. Print. Off., Feb. 1986. p. 14-15.

[105]Forest Service responses to Subcommittees' question 1.

Effects on Other Resources

Livestock grazing generally has little effect on most development activities in the CGYR. The discussion of its effects, therefore, focuses on water and wildlife impacts.

Effects on Water and Watersheds

Grazing can alter water flows and degrade water quality, mainly by removing vegetation and increasing soil erosion. These results can affect downstream water users by increasing costs and filling reservoirs with sediment; this is particularly important for the CGYR because the area contains the headwaters of numerous rivers.

Riparian areas in rangelands are heavily used by livestock (and by wildlife) because of the available water and because of the succulent forage often found along stream banks, but these areas are also relatively fragile, and thus are susceptible to serious damage.[106] Livestock use of riparian areas can degrade water quality and accelerate erosion. The most significant effect results from the grazing of vegetation and the trampling of streambanks; the grazing and trampling destabilize the streambanks, making them highly vulnerable to erosion from storms and spring runoff.[107] In addition, concentrations of cow manure in and near streams can significantly degrade water quality.[108]

Grazing outside the riparian areas can also affect water quality. Grazing and trampling can increase runoff and accelerate erosion, leading to increased stream sedimentation (lower water quality).[109] The FWS stated that grazing on the watershed above Red Rock Lakes National Wildlife Refuge has caused "severe" siltation of Red Rock Creek, while sheep grazing in the Odell Creek watershed (and the presence of a phosphate haul road) has caused "excessive" siltation in Odell Creek and Lower Red Rock Lake.[110]

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[106]Thomas, Jack Ward, Chris Maser, and Jon E. Rodiek. Wildlife Habitats in Managed Rangelands -- The Great Basin of Southeastern Oregon: Riparian Zones. Forest Service General Technical Report PNW-80. Portland, OR, U.S. Dept. of Agriculture, 1979. 18 p.

[107]Livestock Grazing in Riparian Zones: Ensuring Fishery Protection in Federal Rangeland Management. [by Richard Braun.] Anadromous Fish Law Memo, Issue 37. Portland, OR, Lewis and Clark Law School, Oct. 1986. p. 12-13.

[108]Ibid.

[109]Livestock Grazing in Riparian Zones. p. 12.

[110]FWS response to Subcommittees' questions. p. 3.

Certain livestock management practices can protect water quality and riparian areas from the possible damages by grazing. The location of fences, salt, and watering sites generally determine the distribution of livestock.[111] Fences can be built to keep livestock out of riparian areas, although such an approach is quite expensive. Water impoundments scattered throughout an allotment can reduce pressures on streamside riparian zones and other wetlands.[112] Similarly, certain grazing systems (such as deferred rotation and rest rotation) can protect important areas from grazing during critical periods.[113] However, such practices would likely increase costs, particularly for the permittee, and would probably require more activities on the allotments by both the agencies and the permittees.

Effects on Fish and Wildlife

Degraded water quality from livestock grazing can reduce fish populations. Sediment in streams can impede oxygen exchange in the gravel where cutthroat trout eggs develop, and thus reduce spawning success. Lower fish populations would reduce the value of fishing for recreation and could harm other animals dependent on cutthroat trout, such as grizzly bears and bald eagles.

Livestock also compete directly with many animal species. As noted earlier, cattle graze primarily on grass when it is available, and thus compete with elk and bison for forage; sheep are browsers, eating predominately shrubs and herbaceous plants rather than grass, and thus compete with deer for forage. Allotment use is generally allocated in such a way as to allow sufficient forage for existing wildlife populations, but some rangelands are already considered overgrazed and increased elk and deer populations could exacerbate such conflicts. Another potential problem is that the CGYR elk and bison carry brucellosis, a disease which can lead to spontaneous abortions in cattle. Domestic herds in Montana and Wyoming are currently free of the disease, while those in Idaho are nearly free of brucellosis.[114] However, cattle grazing near elk or bison calving grounds could contract the disease.

The most serious conflict between grazing and elk is created by fencing, which may prevent elk from migrating summer and wintering grounds. Some fences have been designed to allow passage of wildlife

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[111]Hall, Frederick C. Wildlife Habitats in Managed Rangelands -- The Great Basin of Southeastern Oregon: Management Practices and Options. Forest Service General Technical Report PNW-189. Portland, OR, U.S. Dept. of Agriculture, 1985. p. 7.

[112]Thomas, et al., Riparian Zones. pp. 10-12.

[113]Hall, Management Practices and Options. p. 4-5.

[114]APHIS response to Subcommittees' questions. p. 1.

(particularly moose and antelope) while restraining livestock, but two fences -- in the Yellowstone River valley north of the Park -- were built to restrict wildlife use of private lands and have prevented the largest of Yellowstone's elk herds (16-18,000 animals) from reaching a substantial portion of their winter range.[115] Fences can cause severe wildlife losses, if they prevent the animals from reaching suitable winter habitat.

Predators can conflict with livestock grazing, and particularly with sheep grazing. Half of the livestock deaths in the CGYR National Forests between 1981 and 1985 were due to predators.[116] Of this, only 114 livestock deaths (less than one percent of the predator kills) have been attributed to grizzlies, including 94 on the Gallatin NF. Thus, it is likely that other predators -- probably coyotes and perhaps golden eagles -- are the primary livestock predators in the CGYR.

Grizzlies can also be killed as a result of their conflict with livestock. The number of bears killed illegally by ranchers is not known, but more than half of all grizzly deaths since 1976 have been illegal kills that probably include some by ranchers. The conflict is particularly acute with sheep.[117] The best protection for grizzlies is probably to minimize the possible contact between sheep and grizzly bears. This might be done by terminating selected sheep allotments, by altering allotment boundaries to exclude areas used by grizzlies, or by shifting certain allotments to cattle grazing. The Targhee National Forest, for example, has chosen to not reissue sheep grazing permits that are waived.[118]

ENERGY AND MINERAL MANAGEMENT

Energy and mineral developments are scattered throughout the CGYR. Mining, primarily for gold, but including many other metals, is generally concentrated to the north and east of Yellowstone Park; there is some interest in coal in the southern reaches of the CGYR. Phosphate mining, principally in the Caribou National Forest, supports a substantial industry in Idaho. Oil and gas activities are predomin-

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[115]Gallatin National Forest response to Subcommittees' question 17.

[116]Forest Service responses to Subcommittees' question 11.

[117]Orme, Mark L. and Robert G. Williams. Coordinating Livestock and Timber Management With Grizzly Bears in Situation I Habitat, Targhee National Forest. In Proceedings -- Grizzly Bear Habitat Symposium. Forest Service General Technical Report INT-207. Ogden, UT, U.S. Dept. of Agriculture, May 1986. p. 200.

[118]Orme and Williams, Coordinating Livestock and Timber Management With the Grizzly Bear. p. 202.

ately confined to the Bridger-Teton NF, although most of the available National Forest lands have been leased. There are many geothermal leases west of Yellowstone, but no geothermal developments have begun.

The BLM is responsible for energy and mineral activities on all Federal lands. In the National Forests, the Forest Service controls the surface access and impacts, and can recommend actions related to leases and claims, but the BLM has the ultimate authority. Energy and mineral activities are allowed in some National Parks (generally under the laws establishing those Parks), but not in Yellowstone or Grand Teton. Similarly, energy and mineral development occurs in some Wildlife Refuges, but none has occurred in Red Rock Lakes NWR, Grays Lake NWR, or the National Elk Refuge.

This section presents information on the energy and mineral activities in the CGYR, the resulting economic effects, and the impacts on other resources. The conclusions are these:

1. Phosphate mining in the Caribou National Forest supports more jobs than any other single activity on the Federal lands in the CGYR, and nearly equals the total jobs associated with recreation in the CGYR National Forests.

2. The major impacts of energy and mineral activities on the ecosystem are:
   a. The potential water pollution; and
   b. The human access created to explore for and develop the resources.

3. There is little opportunity for environmental review of energy and mineral leases, exploration, or development by interested groups, and limited Federal control over exploration and development once leases are issued and claims are filed.

4. Geothermal development appears, at this time, to represent little threat to the hydrothermal resources of Yellowstone National park.

Mineral Activities

Energy and mineral development can affect other resources. Openings in the surface, for example, can cause changes in surface and groundwater quality. The most significant impact is probably the access which accompanies mineral exploration and development; as noted under Timber Harvesting, increased access can harm water quality and animal populations. This may be a more critical issue for energy and minerals, because the land management agencies have less administrative control over these activities, and thus less effective control over the associated access.

In general, there are two approaches by which mineral resources from Federal lands can be acquired: leases and claims. Leases are

used for certain minerals, including most energy resources, under the general authority of the Mineral Leasing Act of 1920.[119] This Act, together with various amendments and supplementary laws, provides the basis for regulating the disposal of coal, phosphates, oil and gas, and geothermal resources from the Federal lands in the CGYR. Most other minerals on Federal lands, commonly referred to as locatable or hardrock minerals, are generally available to claimants under the Mining Act of 1872, as amended and supplemented by more recent legislation.[120]

Leasable Minerals

BLM has the primary responsibility for mineral leases on Federal lands, regardless of which agency manages the surface resources. The surface-managing agency, typically the Forest Service, can recommend areas to be withheld from leasing and can specify stipulations in the leases for protecting other resources, but the BLM has the final authority over issuing leases. Two other Interior Department agencies -- the Minerals Management Service (MMS) and the Office of Surface Mining (OSM) -- are also involved in mineral leasing. MMS handles all receipts from Federal mineral leases, while OSM is responsible for assuring adequate site restoration for abandoned surface mines. (No mining is allowed within the borders of most Parks.)

Coal. Much western coal is mined in strip mines, which can have substantial impacts on water and animals as well as displacing recreation and other activities. Coal exists throughout much of the CGYR, and there is high potential for coal production in the Gros Ventre, Salt River, and Wyoming Ranges south of Yellowstone National Park. However, the U.S. Geological Survey has projected that coal mining in the CGYR is unlikely in the near future due to current economic conditions; much of this coal is relatively deep and would necessitate underground mining, which is much more costly than surface (strip) mining.[121] The Office of Surface Mining indicated that there are no active coal exploration or surface mining operations within the CGYR, but the Cravat Coal Company has an approved coal exploration site in the Bridger-Teton National Forest near Poison Meadows (between the Salt River and Wyoming Ranges), and has attempted to obtain a permit for strip coal mining near McDougal Gap (also in the Bridger-

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[119]Act of Feb. 25, 1920; ch. 85, 41 Stat. 437. 30 U.S.C. 181, et seq. The full title of the Mineral Leasing Act is "An Act To promote the mining of coal, phosphate, oil, oil shale, gas, and sodium on the public domain."

[120]Act of May 10, 1872; ch. 152, 17 Stat. 91. 30 U.S.C. 21 et seq.

[121]USGS response to Subcommittees' questions. p. 27.

Teton in the Wyoming Range).[122] The BLM reported two existing (although inactive) coal leases in Wyoming, at McDougal Gap and northwest of the Gap in the Wyoming Range.[123]

Abandoned coal mines can also affect other resources. According to the U.S. Office of Surface Mining, the States of Wyoming and Montana have identified several abandoned mine sites in the CGYR, but neither State has begun reclamation on these sites. There are three abandoned coal mines in Wyoming, two in the Gros Ventre Range southeast of the National Elk Refuge and one near the Gros Ventre River northeast of the Refuge. In Montana, there are three small abandoned coal sites near Gardiner and six non-coal abandoned mine sites, one near Gardiner, one southwest of Red Lodge, and four north of Cooke City.[124]

Phosphates. Phosphates are generally mined in surface mines, which can affect water and animals as well as displacing recreation and other activities. Most of the phosphate production in the western United States comes from the Caribou National Forest, west of the Webster Mountain Range, and from adjoining private lands; this phosphate area includes the extreme southwest corner of the CGYR.[125] The Caribou has four active phosphate mines, six leases for which mine plans have been prepared, and at least a dozen leased areas without mine plans.[126] Even with this activity, substantial areas of the Caribou with a high likelihood of developable phosphates have not been leased.[127]

There is a large area with moderate to high likelihood of having developable phosphate resources along the Snake River in Idaho and south through the Salt River and Wyoming Ranges.[128] However, no detailed studies of the potential of this area have been conducted, and there are no leases in this area. Finally, there is a moderate likelihood of developable phosphate resources in the Centennial Mountains, between Red Rocks Lake National Wildlife Refuge and Island

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[122]Office of Surface Mining response to Subcommittees' questions. 2 p. plus map.

[123]BLM response to Subcommittees' questions. p. 20.

[124]Office of Surface Mining response to Subcommittees' questions. Map.

[125]USGS response to Subcommittees' questions. p. 12.

[126]BLM response to Subcommittees' questions. Enclosure 19.

[127]USGS response to Subcommittees' questions -- phosphate map; and BLM response to Subcommittees' questions -- enclosure 19.

[128]USGS response to Subcommittees' questions. Phosphate Map.

Park Reservoir.[129] There was some production in this area in the 1950s; some of the phosphate leases have not expired, and two processing plants were proposed there in 1977, although neither was built.[130]

Oil and Gas. Oil and gas exploration, including seismic testing and exploratory drilling, and full field development can have numerous impacts on other resources. Water quality can be affected by the required roads and by the muds which accompany drilling. Animals and humans can be displaced from drilling sites and disturbed by the access and by the explosions of seismic testing. Thus, the location of oil and gas activities and the procedures under which they occur govern the possible effects of oil and gas exploration and development.

Several areas within the CGYR have high hydrocarbon potential, including the eastern edges of the Shoshone National Forest, the Wyoming and Salt River Ranges, the Snake River Valley in Idaho, and the Henry's Lake area.[131] Most oil and gas drilling in the CGYR has occurred in the Bridger-Teton NF. (No information was provided on drilling in the Shoshone NF by either the Forest Service or the BLM.[132]) The Caribou NF has seven abandoned wells, while the Targhee has one abandoned, one active, and one proposed well (all in Idaho, west of Jackson, Wyoming); there is no reported oil and gas drilling in the Montana National Forests in the CGYR. (See Map 6 for well locations.) There are currently 18 producing wells, 9 other active drilling sites, and 38 abandoned wells in the Bridger-Teton NF. Most of these (including 13 producing wells) are concentrated in the Big Piney Ranger District, south of South Piney Creek and near McDougal Gap, but they reach as far north as Blackrock Creek, near Grand Teton National Park. In addition, 13 new wells have been proposed for drilling in the Bridger-Teton; the proposals are similarly concentrated in the Big Piney District, but two are proposed for the south side of the Gros Ventre Range and one near the ridgetop southeast of Mount Leidy.

The BLM is responsible for oil and gas leasing on all Federal lands; under an interdepartmental agreement, the Forest Service reviews lease applications on the National Forests, and BLM generally follows the Forest Service recommendations. For the CGYR, the BLM

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[129]USGS response to Subcommittees' questions. Phosphate Map.

[130]BLM response to Subcommittees' questions. p. 21.

[131]USGS response to Subcommittees' questions. Oil and Gas Map Overlay.

[132]Forest Service responses to Subcommittees' questions. Oil and Gas Map Overlays. Forest Service data concur with BLM response to Subcommittees' questions, but BLM only provided data for Idaho (Enclosure 6).

reported 389 existing leases in Idaho, with 75 additional applications pending; and 6,600 leases in Wyoming, with 40 pending applications due to various appeals or reviews.[133] BLM did not provide data on the number of oil and gas leases and pending applications in Montana, but the Forest Service reported 158 leases in the Gallatin NF and 169 leases (including some lease applications) in the Beaverhead NF.[134]

Map 6 shows the Federal lands in the CGYR which have been leased for oil and gas, or for which leasing applications have been filed. New leases are prohibited in congressionally designated wilderness and wilderness study areas, although valid existing leases can be developed under regulations intended to preserve the wilderness character of these areas. Of the lands available for leasing, the majority have been leased, including lands with little potential for oil and gas discovery; for example, there are leases for oil and gas exploration in portions of the Beaverhead and Gallatin Forests where the U.S. Geological Survey reports no known potential for oil and gas.[135] One group, critical of Federal oil and gas leasing activities in the Yellowstone area, has estimated that 83 percent of available lands have been leased, while the Forest Service has recommended no leasing for less than 4 percent of available lands.[136]

The procedures used for oil and gas leasing and development have been criticized as not providing adequate opportunity for environmental review by interested public groups.[137] While the mere granting of a lease has no direct, immediate impacts on other resources, the exploration typically associated with active leases can have profound effects on water quality, animal populations, and recreationists. The Forest Service stated that National Forest plans currently being

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[133]BLM response to Subcommittees' questions. p. 17, 20.

[134]Gallatin and Beaverhead NF responses to Subcommittees' question 14.

[135]USGS response to Subcommittees' questions. Oil & Gas Overlay.

[136]Sierra Club. Yellowstone Under Siege: Oil and Gas Leasing in the Greater Yellowstone Region. [by Ed Madej] San Francisco, July 1986. p. 6.

[137]There have been numerous complaints about oil and gas leasing on Federal lands, but an analysis of the system is beyond the scope of this report. For more information, see:

U.S. General Accounting Office. Issues Surrounding Continuation of the Noncompetitive Oil and Gas Lottery System; Report to the Chairman, Committee on Interior and Insular Affairs, House of Representatives. Washington, April 4, 1985. GAO/RCED-85-88. 46 p.

U.S. Library of Congress. Onshore Oil and Gas Resources on Federal Lands: Current Issues in the Noncompetitive Leasing System. [by Adela Backiel and Karen Hendrixson.] Washington, 1986. Congressional Research Service Report IB85174. 11 p.

prepared provide general direction on areas available for leasing, with a site-specific environmental analysis occurring when an application to drill is filed; there is little or no environmental review prior to issuing leases.[138] However, leases are generally regarded as contracts which guarantee the right to drill somewhere within the lease. The leases themselves may have no direct effect on other resources, but their existence can effectively lead to a drilling right with virtually no environmental recourse.

Geothermal Resources. Geothermal energy development typically includes using steam or hot water to produce electricity. Such production is typically very noisy at the site, and generates hot wastewater with numerous minerals that can pollute streams. The only known electrical-grade geothermal resources in the CGYR are those in Yellowstone National Park, which cannot be developed. Several low temperature hydrothermal systems (warm springs), which could be used for heat although not for commercial power generation, exist in the CGYR, including one near the town of Ennis, Montana, and two in the Bridger-Teton National Forest, east of the J.D. Rockefeller Parkway and in the Gros Ventre Range.[139]

There are two Known Geothermal Resources Areas (KGRA) in the CGYR. The Yellowstone KGRA, outside the western boundary of the Park, was established by the U.S. Geological Survey because of the available geologic data and thermal evidence.[140] However, this area was withdrawn from leasing in 1981 by BLM to protect the nearby hydrothermal features of Yellowstone National Park; it was feared that geothermal development could disrupt the underground water pressure which causes the geysers inside the Park.

The Island Park KGRA, further south and west, was established because of the numerous, overlapping lease applications. According to the Geological Survey, the geophysical data do not indicate a hot-water resource in that area, and the warmest reported spring temperature is below 12°C (53°F).[141] There are no geothermal leases in the Island Park KGRA, but there are 96 lease applications.[142] Lease application approvals have been postponed because of possible hydrologic connections between Yellowstone Park and the Island Park area. However, the Geological Survey has reported no thermal or chemical

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[138]Targhee National Forest response to Subcommittees' question 14.

[139]USGS response to Subcommittees' questions. p. 14.

[140]USGS response to Subcommittees' questions. p. 15.

[141]USGS response to Subcommittees' questions. p. 15.

[142]BLM response to Subcommittees' questions. p. 17.

evidence for the flow of thermal waters between Yellowstone and Island Park.[143]

Locatable Minerals

The principal effects of hardrock mining on other resources are the impacts of the access for prospecting, mining, and ore removal and the degradation of water quality from the access roads, the opened mineralized surfaces (above and below ground), and the treatment of waste products. Hardrock minerals, and mining claims, are scattered through much of the CGYR. The areas with high mineral potential include the Absaroka Range, north and east of Yellowstone National Park, and the Gros Ventre, Wyoming, Salt River, and Caribou Ranges south of the Park. The principal minerals being sought are gold and silver, but numerous other minerals have been mined in the area, including chromium, copper, iron, lead, molybdenum, nickel, platinum group metals, tungsten, and zinc.

There has been extensive prospecting and mining for metals in the CGYR, particularly in the Gallatin and Custer National Forests; the Cooke City area, Gardiner-Jardine area, East Boulder Plateau, and the area around the south end of the road along the Boulder River all have high mineral potential for many of the metals listed above and numerous producing mines. Lincoln Mountain and Emigrant Peak on the Gallatin NF and Sunlight Creek on the Shoshone NF have also seen recent activity. Several of these areas (Cooke City, Gardiner, and Sunlight Creek) have been identified as areas of grizzly mortality concentrations. (See Grizzly Bear Mortality Clusters, p. 115.) In addition, there has been significant placer mining activity in the Gravelly Range in the Beaverhead NF; placer prospecting has occurred throughout the Gros Ventre River Valley, but no mines have been sited there. Map 5 shows the locations of the active and abandoned mines and prospecting sites in the CGYR.[144]

In addition to metal mining, non-metallic minerals are mined in the CGYR. Talc is mined in the Beaverhead NF, and travertine (a building stone) is mined in the Gallatin NF, near Gardiner. Asbestos has been mined from the Gallatin NF (west of Hebgen Lake), and rock salt from the Caribou NF, but neither of these mines is currently active.

The process for granting development rights to locatable minerals on Federal lands differs substantially from the leasing of leasable minerals. The 1872 Mining Law allows free exploration of most Federal lands. A prospector can stake a mining claim (a physical location) for a mineral deposit, which is recorded with the BLM. To hold a claim, the claimant must perform a minimal amount of some form of

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[143]USGS response to Subcommittees' questions. p. 15.

[144]USGS response to Subcommittees' questions. Minerals Overlays.

development activity each year. The Forest Service requires an operating plan for proposals entailing significant surface disturbance. Claims can be patented, transferring ownership from the Federal Government to the claimant, but a patent is not needed to extract and sell the mineral. The Federal Government collects a fee for recording the claim ($5), for filing for a patent ($25), and for transferring title to the land (generally $2.50 or $5 per acre, depending on the type of claim), but collects no royalties or other payments from locatable mineral extraction on Federal lands.

Some Federal lands, such as National Parks, have been withdrawn from mineral exploration. New mineral claims are prohibited in wilderness areas, but valid existing claims can still be developed and patented under existing regulations. Otherwise, the Federal Government has little authority to regulate mineral exploration. The BLM stated that, other than withdrawing Federal lands, they have no authority to regulate mining:[145]

> The Bureau of Land Management does not have the authority to deny a mining claim. The location and working of mining claims is a non-discretionary action on land that is open to mineral entry.

Energy Transmission Corridors

The Bonneville Power Administration (BPA) has examined several possible corridors for transmitting coal-generated electricity from eastern Montana and Wyoming to the Pacific Northwest. Some of the corridors examined passed through the CGYR, including through various wilderness areas and even through the edge of Yellowstone National Park. (See Map 5.) Phase I of the Pacific Northwest Long Range East-West Energy Corridor Study, completed in 1977, identified corridor segments with adequate topography, geologic stability, and seasonal access; all corridors were considered feasible, and Phase I did not try to evaluate alternative routes.[146] The energy situation has changed dramatically since Phase I was completed, but use of the corridors is still considered a long-range possibility.[147] More

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[145]BLM response to Subcommittees' questions. p. 22.

[146]Dept. of Energy response to Subcommittees' questions. Enclosure 3: U.S. Bonneville Power Administration. Pacific Northwest Long Range East-West Energy Corridor Study: Phase I, Part A - Rocky Mountains. (Draft - Working Papers.) Portland, OR, Dec. 1977. 93 p. plus maps.

[147]DOE response to Subcommittees' questions. Enclosure 4. Letter from Anthony R. Morrell, Environmental Manager, BPA, Portland, OR to Joseph J. Wagenfehr, Forest Supervisor, Beaverhead NF, Dillon, MT. May 31, 1985.

detailed environmental reviews would be required before recommending any particular routes for the rights-of-way. The 600-foot-wide corridors would be barren of trees, and could present substantial barriers to animal movement, as well as altering recreation and other use patterns.

Economic Effects

Comprehensive employment estimates for energy and mineral activities were not provided by the agencies. The following table summarizes the employment estimates that were provided.

TABLE 12. Employment Estimates for Energy and Mineral Activities in the CGYR

	Direct Jobs	Indirect & Induced Jobs
Leasable Minerals:		
Phosphates in Idaho:		
Forest Service	1,200	3,600
BLM	1,800	5,400
Oil and Gas in Idaho:		
Forest Service	20	60
BLM	22	90
Oil and Gas in Wyoming:		
Bridger-Teton NF	0	818
Locatable Minerals:	Direct, Indirect, & Induced Jobs	
Hardrock Mining in Montana:		
BLM	10	

Phosphate mining in the Caribou National Forest appears to be a significant source of jobs in the CGYR, providing nearly as much employment as all forms of recreation combined. The Forest Service estimated that phosphate mining in the CGYR supported 1,200 direct jobs and 3,600 indirect and induced jobs. The BLM also estimated employment from phosphate mining for the same areas in the CGYR, but the estimates were 50 percent above the Forest Service estimates (1,800 direct jobs and 5,400 indirect and induced jobs). The difference between these estimates illustrates the difficulty in determining the employment effects of activities on Federal lands.

The Forest Service estimated that 20 direct and 60 indirect and induced jobs are supported by oil and gas activities in the Caribou NF; this compares with the BLM estimates of 22 direct and 90 indirect and induced jobs from oil and gas activities on Federal lands in the CGYR in Idaho. The Bridger-Teton NF reported 818 indirect and induced jobs from oil and gas activities, but no direct jobs. This is difficult to understand, since indirect jobs are those supplying direct jobs, while induced jobs are those resulting from economic

activity generated by direct jobs. Some direct employment likely is associated with oil and gas activities in the Bridger-Teton, since there are 18 producing wells and 9 active drilling sites in the Forest.

The Forest Service provided no information on jobs resulting from hardrock mining in the National Forests, although there are numerous producing mines in the CGYR. The BLM identified 10 jobs (total) from locatable mineral activity on their lands in Montana.

Effects on Other Resources

Among the principal effects of energy and mineral development are those resulting from the necessary access and the human activities that occur on the sites. Improper road construction can degrade water quality; this can reduce fish populations, and subsequently harm populations of wildlife dependent on fish, such as grizzly bears and bald eagles. The activities themselves can also displace wildlife, particularly for grizzlies which avoid human contact. Thus, unless the location and use of roads is controlled, access has the potential to damage water quality and fish and wildlife populations. (For a fuller discussion, see Access under Timber Harvesting, p. 49.)

Mining and Non-Fuel Mineral Activities

Activities associated with mining claims can affect the other resources of an area. Maintaining a claim requires at least $100 worth of development annually; this is a relatively small amount, and does not necessarily have to occur on the claim proper. In many cases, no work will be done as long as there is no challenge to the claim. Nonetheless, it means that the claimant is entitled to access to the site, and human activities may occur on the site. However, the actual effects are likely to be quite limited -- in both time and space -- until a mine is developed.

There are three basic ways to extract non-fuel minerals: placer mining, underground mining, and surface mining. Placer mining involves the use of running water to concentrate minerals from gravels deposited by past or present streams. The most significant effect of this or other forms of hydraulic mining is that they can introduce heavy sediment loads into clear-flowing streams if improperly operated.[148] Some sediment results from erosion of cleared areas and access roads, but much of it is mobilized during washing gravel to extract the metal (usually gold). Increased sedimentation can harm

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[148]U.S. Department of the Interior, National Park Service. Gates of the Arctic National Park and Preserve: Environmental Overview and Analysis of Mining Effects. Denver, U.S. Govt. Print. Off., June 1983. p. 57.

fisheries by reducing spawning success and eliminating spawning areas,[149] and thus is a concern for the Gros Ventre and Madison Rivers, where placer mining has occurred or is being considered.

The effects of underground mining can be more limited. In some cases, there may be subsidence of the surface above the workings. But the most significant impacts are likely to result from the associated surface facilities, such as the mill, the waste rock, and the tailings pond, although these can be located away from the mine site. For example, the proposed platinum group metal (PGM) mine in the Custer National Forest near Nye, Montana, would require 130 acres in the Forest for the small proposal, but less than 40 acres for the larger proposal because the tailings pond would be six miles northeast (on private land, outside the CGYR) and served by a slurry pipeline.[150] The surface activities would displace wildlife and other development activities in the area, including most recreation, in addition to introducing substantial traffic.

Mines, both underground and on the surface, can harm water quality directly in addition to sedimentation from access roads. Mine openings facilitate movement of air and water into the subsurface mineralized zones, and often promote release of toxic metal ions and the formation of acids through the dissolving of corrosive minerals. This can substantially degrade water quality and damage fish and wildlife populations, if precautions are not taken.[151] In addition, mine tailings contain potentially hazardous compounds which can further degrade both surface waters and groundwater.[152] However, many types of mining -- such as those under consideration for the Stillwater Complex in the Custer National Forest -- have water quality performance standards which generally prohibit the discharge of water used in processing.[153] In these cases, mining might have only limited effects on the surface or groundwater of the CGYR.

Surface mines (strip and open pit mines), even more than underground mines, may displace wildlife and recreation activities from a significant area. Surface mining can raise a lot of dust, which

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[149]National Park Service, Gates of the Arctic. p. 64-65.

[150]Nigbor, Michael T., Stephen R. Iverson, and Paul C. Hyndman. Environmental Issues Related to Mineral Development in the Stillwater Complex, MT. Bureau of Mines Information Circular 9040. U.S. Govt. Print. Off., 1985. p. 7-9.

[151]Surface Mining of Non-Coal Minerals. p. 58.

[152]Miller and Emerick, Secondary Effects. p. 631-633.

[153]Nigbor, Environmental Issues. p. 24-27.

degrades air quality.[154] However, the most conspicuous effect of surface mines is the substantial and relatively widespread change in the land surface.[155] Surface mines without subsequent reclamation create scars on the land which degrade the aesthetic quality of scenic vistas. In any case, the unavoidable alteration of the surface, in addition to the disturbance generated by mining while it is in progress, are probably the most important effects of non-fuel activities on other resources.

Oil and Gas Activities

Exploring and drilling for oil and gas can affect other resources, and the various stages in the process can have different effects. The following discussion focuses on the three major types of activities which can affect other resources: seismic testing, exploratory drilling and well production.

Oil and gas leasing is perhaps the most controversial activity on the Federal lands in the CGYR. One group has asserted that 83 percent of the area available for leasing has been leased. The BLM reported more than 450 existing or pending leases in Idaho, and 6,600 existing or pending leases in Wyoming,[156] while the Forest Service reported more than 325 existing or pending leases in Montana.[157] The Bridger-Teton, Caribou, and Targhee Forests identified a total of 19 producing oil and gas wells and 10 more drilling applications, while 46 wells have been abandoned.[158]

The mere granting of a lease may not have any immediate direct effect on other resources. However, the seismic testing and exploratory drilling typically associated with active leases can have substantial impacts. Seismic activity is usually associated with those leases under consideration for active development, and such exploration may eventually occur on any lands open to leasing. Under BLM and Forest Service regulations, a company may conduct seismic

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[154]Miller, Silver and J.C. Emerick. The Secondary Effects of Mineral Development. In The Economics of the Mineral Industries. William A. Vogely, ed. New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, 1985. p. 625-627.

[155]Environmental Effects of Mining. In Surface Mining of Non-Coal Minerals. Washington, National Academy of Sciences, 1979. p. 40-62.

[156]BLM response to Subcommittees' questions. p. 17, 20.

[157]Gallatin and Beaverhead NF responses to Subcommittees' question 14.

[158]Forest Service responses to Subcommittees' questions. Oil and Gas Map Overlays for Bridger-Teton, Caribou, and Targhee Forests.

tests in anticipation of leasing favorable tracts in an area; they need not have a lease in the area. Finally, leases normally provide a guarantee that drilling can be pursued somewhere within the company's lease holdings. However, the Federal Government has the right to deny applications to drill on specific sites within a lease.

Seismic Testing. Geologists probe rock formations with the potential for being oil and gas reservoirs by examining recordings of shock waves sent through the earth. In some places, mechanical "thumping" devices (trucks with large weights) can be used to send the shock waves, but the relatively roadless nature of the CGYR strongly suggests that explosives would be used.[159] The explosives are typically arranged in parallel lines, and detonated simultaneously. Each explosion does some damage, although such effects are localized and the areas generally revegetate naturally in a year or two. However, the lines can still often be seen from a distance, possibly disrupting scenic views. In addition, the wires and debris which are left behind can entangle and even kill animals. Finally, the trails created for the seismic testing can increase human traffic in the area, and may be the most significant and long-term effect of seismic testing.

The most significant transient impacts of seismic testing while it is in progress result from associated human activity and the noise and concussion of the blasts. Many of the lines of explosives are laid out in roadless backcountry, with crews sometimes flown in by helicopter; such activities bring many people into areas previously accessible only on foot or horseback, and thus can disturb wildlife which has adapted to a near-absence of human populations. Wildlife species which are relatively intolerant of human activity, such as grizzly bears, will likely be disturbed, and one group asserted that elk and bald eagles have been affected by seismic testing.[160] The noise and concussion of explosions can disturb recreationists as well as wildlife. The blasts can allegedly be heard for a dozen miles,[161] and such evidence of human presence can degrade the outdoors experience for backcountry users and other who want to "get away from it all." To date, there is little research to fully assess the effects of seismic exploration -- while it is in progress or subsequently -- on wildlife populations or on recreation.

No data have been collected identifying the extent of seismic testing in the CGYR. As noted earlier, leasing is not a prerequisite

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[159]U.S. Library of Congress, Congressional Research Service. Assessing the Mineral Potential of the Federal Public Lands. [by John J. Schanz, Jr., and John G. Ellis.] Report No. 83-98 S. Washington, May 1983. p. 76-77.

[160]Sierra Club, Yellowstone Under Siege. p. 9

[161]Sierra Club, Yellowstone Under Siege. p. 9.

for seismic exploration on Federal lands. Rather, the testing can be used to determine whether and where to lease. Each test provides proprietary information to the tester. Thus, several seismic tests by competing enterprises could occur in the same area over a period of time. Reducing the degree of sequential seismic work, perhaps by providing for an exchange of seismic data on some basis following a period of exclusive use, could limit the environmental damages of seismic exploration.

Exploratory Drilling. Seismic tests can only indicate favorable structures and formations; drilling is needed to confirm the existence of oil and gas. For Federal lands, a lessee files an application for permit to drill (APD). The surface-managing agency (Forest Service for the National Forests) then reviews the site-specific APD, and can deny it based on environmental grounds. The Government has stated that drilling must be allowed somewhere on any given lease, but only about 1 lease in 10 has an exploratory well drilled on it.[162]

An exploratory drill site requires several acres to accommodate the drilling pad and the sump pond for the rock chips produced and drilling muds used in the drilling. As with mining, oil and gas drilling can degrade water resources, although sump ponds are lined to reduce possible pollution. However, exploratory drilling (and development drilling if a discovery is made) requires sizable supplies of fresh water. In some of the drier areas, the water requirements could reduce streamflow during critical periods for fish and wildlife.

Exploratory drilling displaces wildlife and other development activities (timber harvesting, grazing, recreation, etc.) from a relatively small area, as with underground mining. However, road access is generally needed to bring in the drilling equipment and crews; even when helicopter access is specified, the frequent fly-overs would likely establish a travel corridor which could restrict wildlife movement. Thus, the most significant impact of exploratory drilling is likely the human access provided to the drilling site.

Exploratory drilling may have only temporary effects, if insufficient oil or gas is found. Dry wells are generally capped, and the sites are often restored naturally in a few years. However, road access to such sites may continue to be used by others -- by loggers or elk hunters, for example. Thus, the access provided for exploratory drilling could have effects which last long after drilling has ceased.

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[162]Personal communication with Karl Duscher, Branch Chief for Leasing Management, Bureau of Land Management, Washington, DC. October 24, 1986.

Oil and Gas Production. The effects of producing wells are similar to those of exploratory wells; the differences are in the time and extent of the effects. A single, unsuccessful exploratory well is a transient event lasting only a few months to a year. The development of a field can be anything from the original single exploratory well on a small discovery to dozens of wells across hundreds of acres. Development may last several years and the drilling sites are typically larger than for exploratory wells. Traffic will be substantial while the wells are drilled and outfitted with the necessary equipment and storage facilities. Small-diameter gathering pipelines (up to an inch in diameter) may be laid down to collect and move the oil and gas from various adjacent leases to a central processing site. Once fully developed, the human presence will decline markedly, since production is highly automated. However, inspection, maintenance, and other activities will continue to occur at the well sites sporadically through the life of the field, which may be measured in decades. There are currently 19 producing wells in the CGYR, with most (13) concentrated in the Big Piney Ranger District of the Bridger-Teton National Forest.

Geothermal Activities

To date, the only geothermal activity in the CGYR is the leasing of some Federal lands, mostly near Island Park Reservoir. As with oil and gas leases, a geothermal leaseholding might have no direct impacts on other resources; the effects result from activities (such as drilling) which may occur because of the lease. In addition to the potential damages caused by increased human access, geothermal energy drilling could alter water supplies. Hot water releases from a geothermal operation could increase stream temperatures, which could harm trout populations and thus the wildlife and recreation associated with those fish species. The hot brines contain dissolved minerals and are thus corrosive; their ultimate disposal presents a problem which has yet to be solved. The drilling could also alter underground hydrothermal systems, such as the geysers in Yellowstone National Park, but the U.S. Geological Survey reported that a link between Island Park Known Geothermal Resource Area and Yellowstone is unlikely.[163] Finally, the energy must be used on the site, so the construction and operation of a power plant or other facility requiring heat is involved.

Energy Transmission Corridors

Powerlines, moving energy in, out, or across the CGYR, can affect wildlife and recreation. As noted under Water Developments, energy corridors can encourage access to previously unavailable areas, particularly for all-terrain vehicles. Of particular concern are the major east-west corridors considered by Bonneville Power Administra-

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[163]USGS response to Subcommittees' questions. p. 15.

tion; these corridors would include a 600-foot wide right-of-way, carrying up to three Ultra High Frequency lines. The straight clearings typical of such corridors are not particularly attractive, and could detract from recreation values in the area. In addition, an extended opening of this size could serve as a barrier to wildlife movement, especially for wildlife species which prefer cover for traveling. Thus, major energy transmission corridors could harm wildlife populations by altering migration patterns.

RECREATION

This section provides general information on recreation use and imputed economic values of recreation, as developed by the Forest Service to use in evaluating tradeoffs in land management planning. More specific information is then provided on use, resulting economic activity, and other effects for downhill skiing; campgrounds, picnic areas, and resorts; hunting and outfitters; sport fishing; and hiking, backpacking, and cross-country skiing. There are several major findings.

1. Recreation supports more employment than any other activity in the National Forests, and except for phosphate mining in the Caribou National Forest, is responsible for two-thirds of the jobs resulting from all activities in the National Forests.

2. More recreation is dispersed throughout the area than occurs at developed sites, although the imputed economic values for developed recreation are generally higher. The dispersed recreation occurs along roads primarily built for other uses (timber harvesting, etc.). This human intrusion into the farthest roaded reaches of the CGYR is probably the most significant impact of recreation on the ecosystem.

3. The economic value of recreation used by the Forest Service for evaluating management alternatives appears to be only distantly related to the local economic benefits, and inconsistent among adjoining Ranger Districts. These inconsistent values may result in inaccurate comparisons between recreation and other resources.

4. The data on levels and locations of various recreation activities are incomplete and inconsistent among agencies. National Park Service data particularly were lacking, but other agencies provided data which were incomplete over time and organized in categories which limit their utility in making management decisions. There was virtually no data on recreation use by locations for the Park Service and the Fish and Wildlife Service.

Recreational Activities

Recreational activities include a diverse group of actions by people visiting the Parks and Forests for enjoyment. In Yellowstone National Park, visitation has increased spectacularly over the years. From 5,438 visitors at the Park in 1895,[164] visitation rose to 2,262,900 in 1984. Grand Teton National Park reported 2.24 million visitors in 1984, with a significant overlap of visitors to the two Parks.[165] Forest Service data showed more than 7.1 million visits to the CGYR National Forests in 1984; many of these visitors also visited Yellowstone NP. In sum, there may have been as many as 10 million visits to the Federal lands in the CGYR in 1984.

Some activities require intensively developed sites, while other activities can occur with no supporting facilities. The Forest Service divides recreation into two basic categories: dispersed and developed. Developed recreation sites result from "management intent in investing money in site modification and facility installation."[166] Some activities, such as downhill skiing, occur only at developed sites. On the other hand, some kinds of fishing, for example, might be considered developed while other kinds would be dispersed; the classification would depend on any ancillary facilities such as docks, toilets, etc.

Figure 6 graphically shows the number of Recreation Visitor Days (RVDs)[167] spent in 1984 in developed and dispersed recreation in the CGYR National Forests, by Ranger District.[168] In three Districts,

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[164]The GYE Bald Eagle Working Team. A Bald Eagle Management Plan for the Greater Yellowstone Ecosystem. Wyoming Game and Fish Dept., Nov. 1983. p. 20.

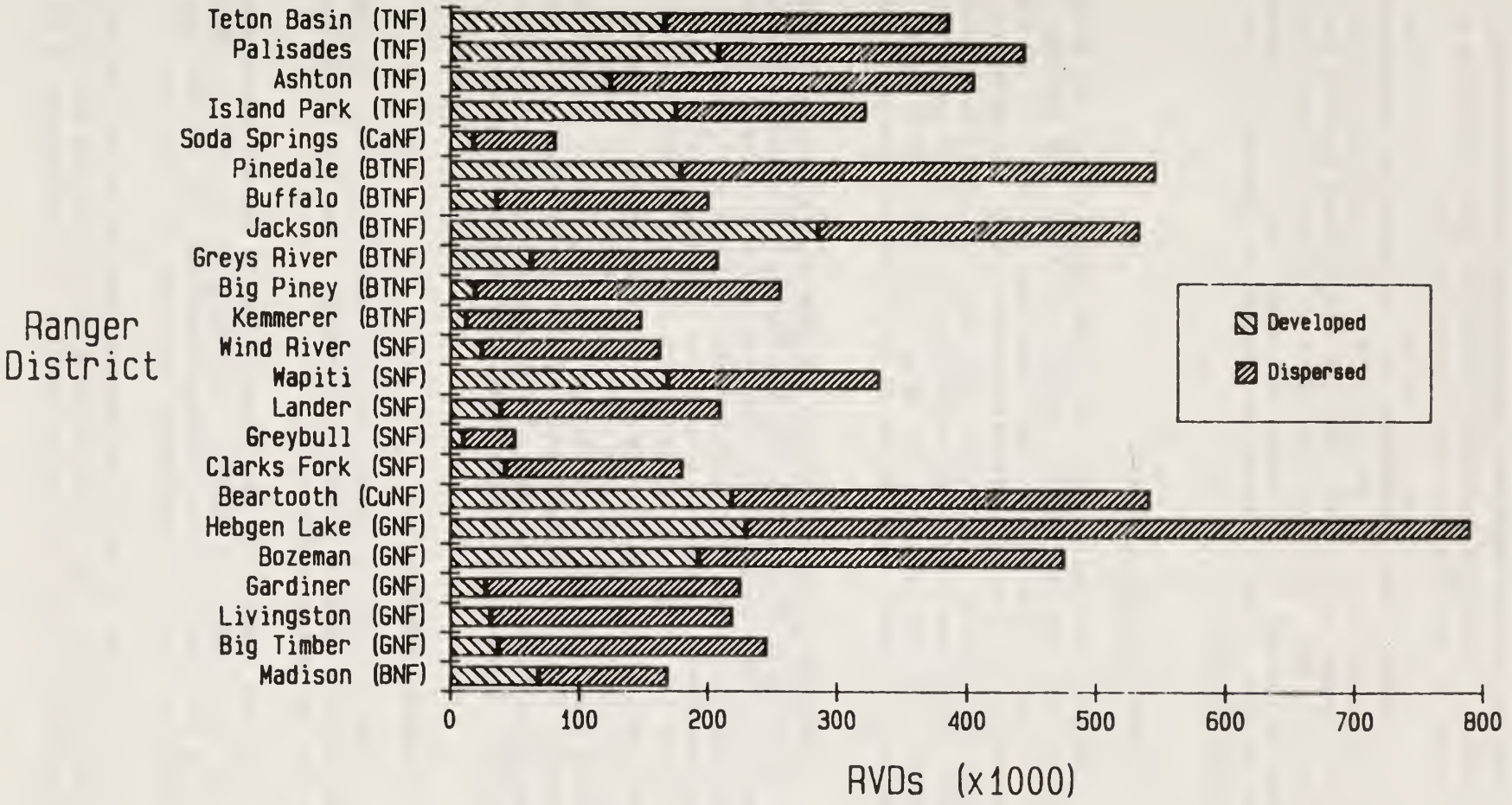
[165]Grand Teton National Park Superintendent Jack E. Stark's response to Subcommittees' question 3.

[166]U.S. Department of Agriculture, Forest Service. Recreation Information Management (RIM) Handbook -- Appendix A: Teaching Unit #9, Subcourse 435C and DCE142. Unpublished draft. p. 13. Hereafter referred to as Forest Service RIM Handbook.

[167]A Recreation Visitor Day is defined as "Recreational use of National Forest sites, or areas of land or water, which aggregates 12 visitor-hours [sic]. May consist of 1 person for 12 hours, 12 persons for 1 hour, or any equivalent combination of continuous or intermittent recreation use by individuals or groups." Source: Forest Service RIM Handbook. p. 84.

[168]Data provided by the Recreation Office of the Forest Service in Washington, DC, for entire Ranger Districts. Districts with disjunct parts outside of the CGYR are included in the figures, and thus totals may overstate CGYR recreation in the Gallatin NF and the Custer NF.

Figure 6. Recreation Visitor Days (RVDs) by Ranger District in FY84



developed recreation exceeded dispersed recreation by a small margin, but overall, dispersed recreation accounted for two-thirds of the recreation in the CGYR National Forests in 1984.

The Forest Service provided data on recreation use by several types of activities. As shown in Table 13, camping and picnicking are the most common activities. Hunting and fishing account for nearly one million RVDs, while certain kinds of dispersed recreation -- hiking, dispersed tent camping, and cross-country (X-C) skiing -- are also popular. Finally, there are several ski resorts in the CGYR National Forests.

Recreation Data Problems

The only recreation data collected annually for all units of the National Park System concern overnight visitors and entrance statistics. Data on type of overnight stay were provided to the Subcommittees, but no data were available on other types of activities, such as hiking and fishing. Recreation data are only marginally better for the National Park Service's sister agency, the Fish and Wildlife Service. The FWS reported some data on hunting and fishing, but apparently collects information on few other categories of recreational activities.

Ironically, recreation data are far more extensive and available for the Forest Service than for the Nation's premier recreation agency, the National Park Service. However, the Forest Service data, while more extensive and computerized, present their own problems of interpretation. The chief problem is that the Service's definitions of activities do not fit an intuitive concept of what such terms should include--a Service-wide problem that is not unique to the CGYR. (See especially "Camping" and "Hiking", below.) In addition, reported numbers are often the local managers' best guess of actual levels of activity, rather than the result of surveys or samples. Notwithstanding the weaknesses and gaps of the Forest Service's raw data, some comparisons can be made, but usually not between agencies.

Downhill Skiing

There are nine operating downhill ski resorts in the CGYR, and three more in various stages of planning. (See Map 7 for locations.) The nine operating areas are:

(1) Red Lodge Mountain-Grizzly Peak in the Beartooth Subdistrict of the Custer National Forest. According to the Forest Service, the area is not known to have financial problems, and in fact has made "significant capital investments" over the last 10 years.

(2) Big Sky in the South Bozeman District of the Gallatin National Forest. The Forest Service noted that the area has returned approximately $28 million on an initial 1970 investment of $7 million

TABLE 13. Recreation Visitor Days in the CGYR National Forests During 1984 in thousands of RVDs)[1]

	Beaver-head NF	Gallatin NF	Custer NF	Shoshone NF	Bridger-Teton NF	Caribou NF	Targhee NF	FS Total
Downhill Skiing	0.0	60.9	58.6	6.2	112.4	0.0	113.7	351.8
Resorts & Cabins	11.5	62.7[2]	20.8[2]	60.5	69.3	1.0[2]	91.0	316.8
Campgrounds[3]	73.7	137.9	50.8	126.6	183.4	73.4	198.4	844.2
Picknicking[4]	17.2	42.3	263.2	12.6	35.6	38.1	62.8	471.8
Hunting[5]	34.8	152.5	16.3	62.3	113.8	9.5[6]	62.9	452.1
Fishing[5]	22.4	160.8	38.3	76.4	120.8	31.9	73.9	524.5
Dispersed Camping[5]	3.7	68.1	47.1	82.0	123.4	9.8	32.9	367.0
Hiking[5]	8.5	109.9	51.7	71.6	92.2	1.4	43.9	379.2
X-C Skiing[5]	2.6	34.0	5.5	6.9	23.1	0.0	27.7	99.8

[1]Data in this Table for X-C skiing and hiking were provided in response to the Subcommittees' questions to each National Forest, except for the Bridger-Teton. All data All data for X-C skiing and hiking categories for the Bridger-Teton, and all data for dispersed tent camping for the seven National Forests were provided by the Recreation Office of the Forest Service in Washington, D.C.

[2]RVDs for resorts not reported.

[3]Does not include tent camping; numbers refer to entire National Forest, including parts outside of the CGYR.

[4]Numbers refer to entire National Forest, including parts outside of the CGYR.

[5]Districts entirely outside of CGYR are not included, but numbers include Ranger Districts with some Subdistricts outside of the CGYR: Bozeman, Livingston, and Big Timber in the Gallatin; and Beartooth in the Custer.

[6]1985 data.

by the developer. One day lift tickets cost $22 for the 1986-87 season.

(3) Red Lodge Ski Camp in the Clarks Fork District of the Shoshone National Forest. This is a very small facility, with no more than 200 Recreation Visitor Days annually from 1976-1984. According to the Shoshone National Forest, the facility "showed a loss in 1982, but operated profitably in 1983-84."

(4) Sleeping Giant in the Wapiti District of the Shoshone National Forest. This area is also fairly small. The USFS says the area "has failed to show a profit in the last three years (1982-84), and visitor days are declining."

(5) White Pine in the Pinedale District of the Bridger-Teton National Forest. Use at this area is "on a slight downward trend," according to the Forest Service.

(6) Snow King Mountain in the Gros Ventre District of the Bridger-Teton National Forest. Use at this area is "on a slight upward trend."

(7) Jackson Hole also in the Gros Ventre District. Use at this area "has increased only slightly in recent years and may be stabilizing." One- day lift tickets cost $26 for the 1986-87 season.

(8) Kelly Canyon in the Palisades District of the Targhee National Forest. The Targhee calls the area "economically sound," but another Targhee ski area did not renew its permit in 1984 because of marginal economics.

(9) Grand Targhee in the Teton Basin District of the Targhee National Forest. The Targhee response says that the area is "economically sound."

In addition to the nine operating areas, there are three areas at various stages of planning or development. The most controversial of these is Ski Yellowstone in the Hebgen Lake District of the Gallatin National Forest. (See discussion below under Effects on Other Resources.) Two additional ski areas, in the Targhee National Forest, are proposed, one near Sawtell Peak south of Henry's Lake, and another near Teton Pass.

Campgrounds, Picnic Areas, and Resorts

Map 7 shows the location of all campgrounds and picnic areas, resorts, ranches, and lodges in the CGYR, and Table 14, shows the number of campgrounds and picnic areas within each jurisdiction. These facilities are generally clustered along the roads leading up the valleys of the National Forests and along the network of roads through the National Parks and Wildlife Refuges. They are also, as might be expected, areas with high levels of other recreation activ-

ities, such as fishing and (where legal) hunting. (See "Fishing" and "Hunting", below, for discussions of these activities.)

TABLE 14. Numbers of Campgrounds and Picnic Areas Within the CGYR (Picnic facilities are not noted separately if they are associated with campgrounds.)

	Camp-Grounds	Picnic Areas		Camp-Grounds	Picnic Areas
Br.-Teton NF	29	4	Yellowstone NP	9	42
Beaverhead NF	9	0	Grand Teton NP	9	5
Caribou NF	4	0	Rockefeller Parkway	2	0
Custer NF	14	2	Park Service Subtotal	20	47
Gallatin NF	41	6			
Shoshone NF	42	6	Red Rock Lakes NWR	2	0
Targhee NF	26	0	National Elk Refuge	0	0
Forest Subtotal	165	18	Grays Lake NWR	0	0
			FWS Subtotal	2	0
			CGYR Total	187	65

Table 13 (p. 87) shows the overnight stays in campgrounds and in resorts and cabins for FY84 for all seven of the National Forests in their entirety in the CGYR. Picnicking is generally not the most frequent recreational activity in the CGYR, but if one assumes that a typical picnic does not take more than three hours, then the 42,300 RVDs of picnicking in the Gallatin NF, for example, represent at least 129,000 persons picnicking in that Forest.

Table 15 shows overnight stays for the three National Park System areas in 1984, the most recent year for which statistics are available. Overnight visits to resorts, lodges, and recreational cabins are common, as is camping in various forms.

TABLE 15. Overnight Stays in National Park Units in 1984 (Stays in thousands; * = less than 1,000)
Source: U.S. Department of the Interior, National Park Service. National Park Statistical Abstract 1984. Denver, 1984.

	Concession Lodging	Camp-grounds	Backcountry	Other[1]	NPS Total
Grand Teton NP	189	244	24	26	483
Rockefeller Parkway	22	47	*	*	69
Yellowstone NP	600	641	33	11	1,285
Total	811	932	57	37	1,837

[1]Includes overnight stays camping in organized groups, sleeping aboard boats, and any other type of stay not reported in another category. Campground stays include both concession-owned and NPS campgrounds.

Hunting and Outfitters

The Forest Service divides hunting into four categories: big game, small game, upland birds, and waterfowl. Big game hunting predominates in the CGYR, and for this analysis, all four subcategories have been added together. Figure 7 shows the distribution of hunting pressure in the Federal administrative units of the CGYR where hunting is allowed. The Bridger-Teton, Gallatin, Targhee, and Shoshone National Forests accounted for 88.4 percent of all hunting Recreation Visitor Days in the National Forests of the CGYR in 1984. Interestingly, the National Elk Refuge (NER) actually has the lowest hunting activity of the nine jurisdictions. This Refuge is, however, the destination for much of the huge migration of elk travelling from Yellowstone National Park south through the Bridger-Teton. By providing winter habitat, the Refuge makes possible the high levels of hunting activity in the Bridger-Teton.

It is difficult to assess fully the hunting activity in the CGYR because of gaps in the data. The most striking of these gaps is at the Caribou National Forest, which stated "Hunting RVD data for 1976 thru [sic] 1984 were not kept on the Forest, but probably can be acquired from the archives in Washington, D.C."[169] Another anomaly occurs on the Beaverhead, which reported identical statistics for all four subcategories of hunting for 1979, 1980, and 1981. These statistics were identical not only for the Madison District as a whole, but also within each of the Subdistricts.

Sport Fishing

Map 7 shows the areas of the CGYR judged by Federal land managers to have especially heavy fishing use relative to other areas in the same jurisdiction. The areas indicated on the map are not the same as the areas of the best fishing, but rather the areas of the most fishing, based on the judgments of the area's various managers. Several areas, both in and out of the two Parks, offer outstanding recreational fisheries, in the view of some observers.[170] The most heavily used areas are listed in Table 16, on p. 92.

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[169]Caribou National Forest response to Subcommittees' question 17.

[170]Wright, Mary, representing the Montana Council of Trout Unlimited. Greater Yellowstone Ecosystem Oversight Hearing. p. 569-571.

FIGURE 7. Hunting Recreation Visitor Days in the National Forests and Two Wildlife Refuges of the CGYR, 1976-1985
Targhee National Forest did not provide data for 1976-1977. Statistics from only those Ranger Districts of a National Forest actually within the CGYR have been included in the Figure; Subdistricts outside the CGYR are not included. (Note that each row of the graph has a different vertical scale.)

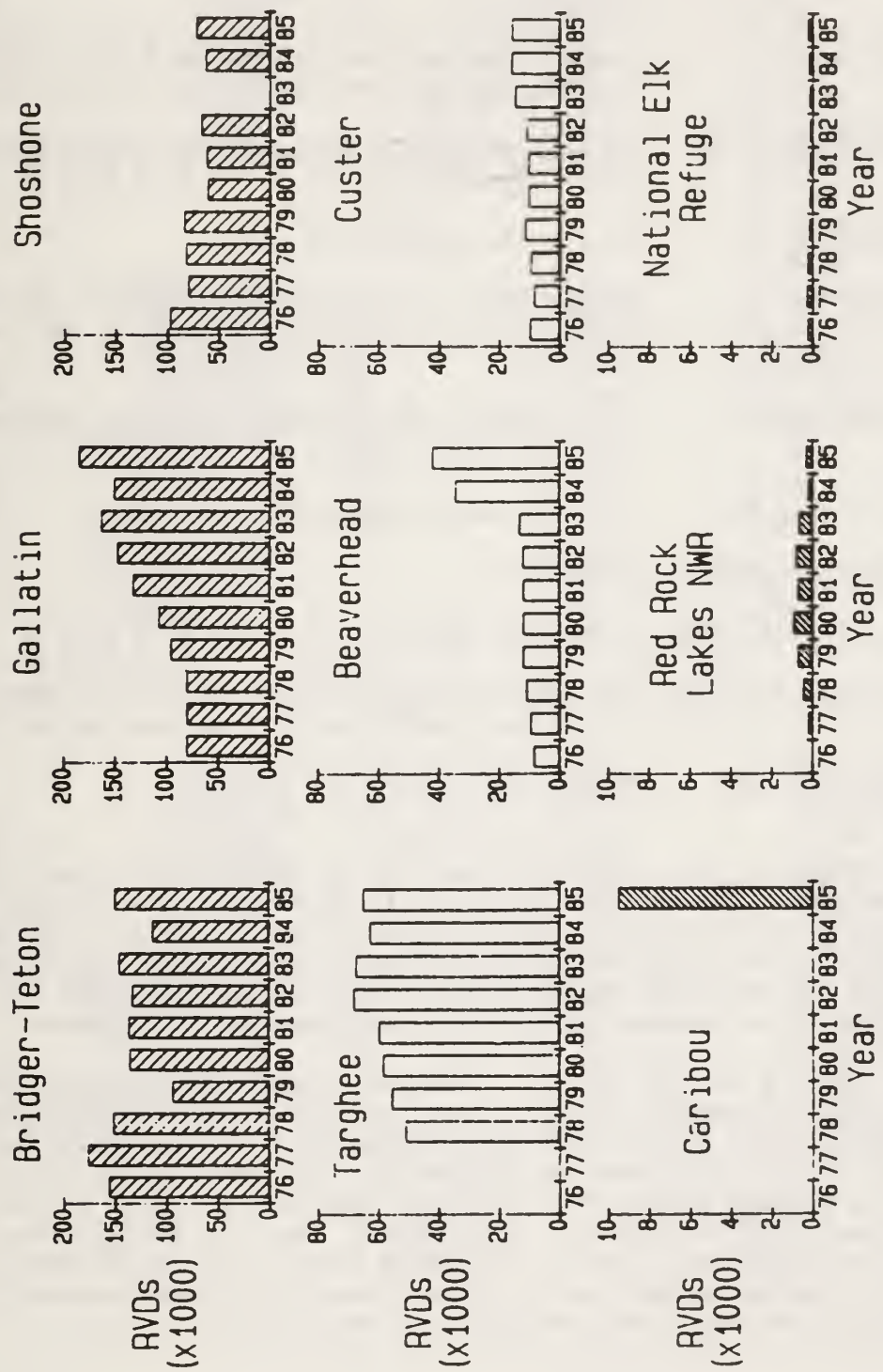

TABLE 16. Heavily Used Fishing Areas Within the CGYR Federal Lands

Area	Heavily Used Fishing Areas
Beaverhead NF	Madison River (& certain tributaries)
Gallatin NF	Hebgen Lake; Gallatin River; Yellowstone River
Custer NF	Tributaries of the Yellowstone River flowing northeast
Shoshone NF	Clark's Fork of the Yellowstone River; the North Fork of the Shoshone River; and the Wind River
Bridger-Teton NF	Several artificial impoundments in the Wind River Range; Snake River
Caribou NF	Only a few scattered areas
Targhee NF	Henry's Fork, the Palisades Reservoir (on the Snake River); Island Park Reservoir; and Henry's Lake
Yellowstone NP	Yellowstone Lake; Yellowstone River; Madison River; Firehole River; and Gibbon River
Grand Teton NP	Jackson Lake; Snake River
Rockefeller Parkway	Snake River
National Elk Refuge	Lower Flat Creek
Red Rock Lakes NWR	Elk, Odell, Grayling, East Shambo, Red Rock, and Tom Creeks; MacDonald, Wigeon, and Culver Ponds
Grays Lake NWR	No response

Figure 8 shows the number of fishing Recreation Visitor Days on those parts of the National Forests in the CGYR. (The Targhee did not report data for 1976-77.) In the CGYR in 1985, RVDs for fishing were highest in the Gallatin National Forest and lowest in the Beaverhead. Use of the two most heavily fished areas, the Gallatin and the Bridger-Teton, appears to have declined over the last decade.

Fishing RVDs at Red Rock Lakes National Wildlife Refuge and the National Elk Refuge were extremely low, with a peak of 3322 RVDs for Red Rock Lakes in 1977 and of 866 RVDs for the National Elk Refuge in 1985. Fishing at these two refuges was less than one per cent of all of the fishing RVDs in the CGYR. No data were provided for Grays Lake National Wildlife Refuge. Consequently, data for the Wildlife Refuges were not included in Figure 8. There are no data for fishing RVDs at any of the three National Park System units, although managers did indicate the areas they thought were most heavily fished.

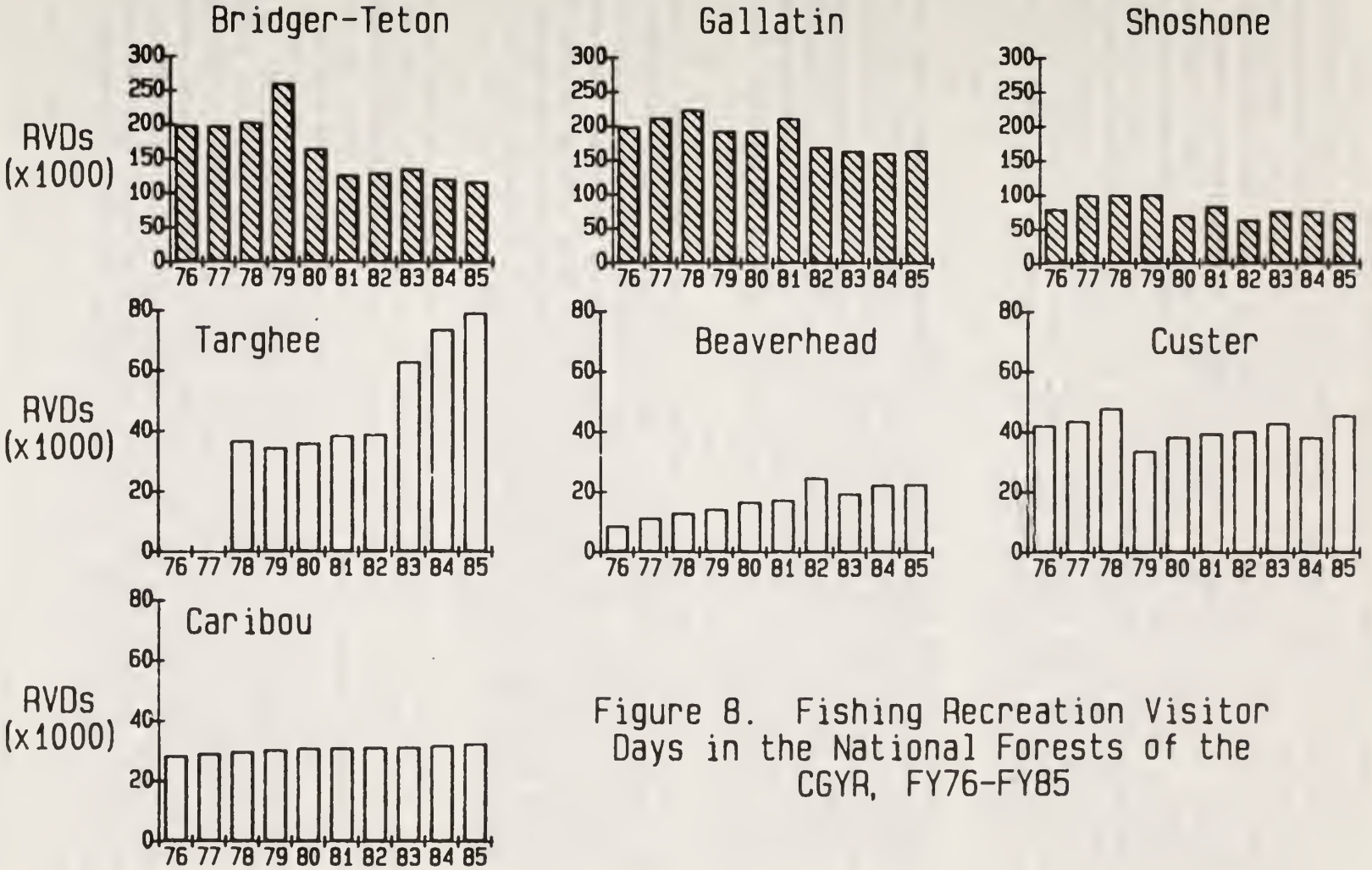

Figure 8. Fishing Recreation Visitor Days in the National Forests of the CGYR, FY76-FY85

Hiking, Backpacking, and Cross-Country Skiing

Analysis of the impact of hiking and backpacking is difficult for two reasons. First, the National Park Service and the Fish and Wildlife Service collect very few data on the subject. Second, while the Forest Service collects more voluminous data, the material is difficult to use because of unconventional definitions of these subjects. "Camping", for example, is divided into four categories: "Camping--General Day"; "Camping--Auto"; Camping--Trailer" and "Camping--Tent." According to the Forest Service[171], any and all of these activities may take place in a developed campground. Only the first and last can occur along a trail, remote from any road. The definition of tent camping also makes clear that activities of backpackers while on the trail or away from their tents should not be included in that activity code.

Moreover, the definition of "Hiking and Walking" is also unusual: "Foot travel (including jogging) for pleasure or access. Includes sightseeing while traveling and rest or leisure stops that are not significant enough to report as specific activities." No other category of recreation is any closer to those activities usually considered hiking or backpacking (here defined as walking, away from a road, across country or on a trail, while typically carrying a pack that contains food and other supplies for a trip of several hours to one or more days).

As a result, it is impossible to estimate the amount of hiking and backpacking for any area of the CGYR based on data available to the Subcommittees. It appears that information is not collected on hiking and backpacking by <u>any</u> agency active in the CGYR. The Forest Service categories of "camping" (i.e., all four categories used by the Forest Service) and "hiking" should not be considered surrogates for backpacking, but do -- presumably -- include backpacking as an unknowable percentage of their total values.

One can only speculate on the level of hiking activity in the three National Park System Units and the three National Wildlife Refuges. Hundreds of miles of trails cross these six areas, and use is probably intense near roads in the summer. Some areas are periodically closed to hikers because of grizzly bear activity or the presence of whooping cranes, nesting trumpeter swans, and other wildlife management concerns. The effects of these closures on hikers are unknown, since no basic data are available on levels of hiking under normal circumstances. However, data are available (see Figure 9) for "backcountry overnight stays" for the National Park System, which seems to be the best available surrogate for backpacking activity. However, these figures may include individuals whose main activity during the day is fishing, riding or other activities.

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[171]Forest Service RIM Handbook. p. 95.

Cross-country skiing (or "X-C skiing") is divided into two subcategories: skiing on "set" or "groomed" tracks prepared by snow machines, and skiing on trails or open country without such grooming. The former class is popular especially with those interested in high speed performance and competition, but cannot occur in very steep or wilderness areas, since snowmobiles would be physically or legally unable to groom trails in such places. This type of cross-country skiing is often provided at downhill ski resorts, and cross-country skiers of unusual ability may even use downhill slopes. Cross-country skiing on ungroomed tracks is typically popular with those interested in wilderness or wilderness-like experiences. Less experienced skiers might find that old roads and easy trails offer a suitable challenge and, in winter's silence, still provide the solitude they seek. Forest Service recreation statistics do not distinguish between these two types of cross-country skiing.

Figure 9 shows Recreation Visitor Days for hiking, dispersed tent camping, and cross-country skiing in FY84 in the Ranger Districts of the National Forests and for "backcountry overnight stays" in the three National Park System units. (This measure appears to be equivalent to the Forest Service's dispersed tent camping. Forest Service data were not available by Subdistricts, so levels shown in the graph are for entire Districts, even if part of the District is not in the CGYR.) Surprisingly perhaps, these recreation activities are not overwhelmingly concentrated in those Ranger Districts adjacent to the National Parks. For example, the Pinedale Ranger District, by far the leader in RVDs for these types of recreation, is as far from Yellowstone National Park as any other District in the Bridger-Teton. At least two Ranger Districts (Pinedale in the Bridger-Teton and Beartooth in the Custer) had levels of dispersed tent camping that even exceeded the "backcountry overnight stays" of the two National Parks. At the same time, Hebgen Lake, a District adjacent to Yellowstone National Park, and which ranks very high in fishing pressure, is only intermediate for these forms of recreation.

Economic Effects

Employment

In the National Forests, visitors make very substantial expenditures for recreation, producing large numbers of jobs. Recreation activities generally provide the largest number of reported direct jobs in six of the National Forests in the CGYR: Gallatin (92.5 percent of direct jobs); Custer (99 percent); Beaverhead (87.1 percent); Bridger-Teton (79.1 percent); Shoshone (91.4 percent); and Targhee (79.1 percent). For the part of the Caribou within the CGYR, recreation accounts for only 3.7 percent of total direct jobs, the low proportion due primarily to the very high number of phosphate mining jobs in that Ranger District.

Table 7 (p. 41) shows direct and indirect jobs in the National Forests resulting from various recreational activities. Hunting,

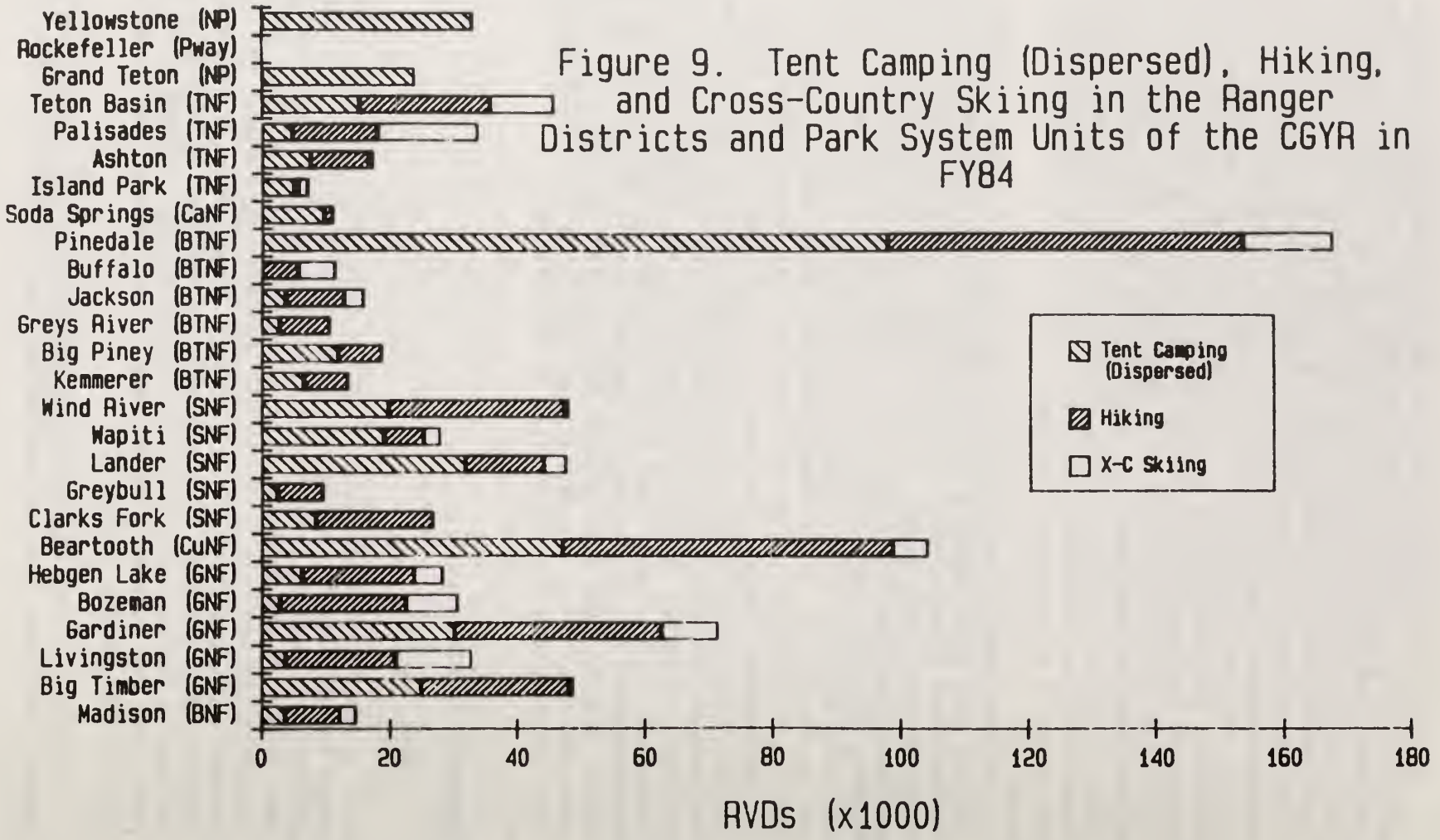

Figure 9. Tent Camping (Dispersed), Hiking, and Cross-Country Skiing in the Ranger Districts and Park System Units of the CGYR in FY84

fishing, and skiing create many jobs, but other recreation activities (lodging, resort ranches, riding, camping, bird-watching, snowmobiling, etc.), which are only reported in the aggregate, are consistently among the largest generators of jobs, comprising over 50 percent of all reported direct jobs for most of these National Forests.

As shown in Table 7 (p. 41), estimated direct jobs from the existing ski areas range up to 306 on the Targhee. (The Shoshone National Forest does not keep separate records of downhill skiing jobs, since the numbers are so small: the Shoshone accounted for less than two percent of CGYR downhill skiing Recreation Visitor Days in 1984.) There were 709.5 direct jobs in the CGYR due to downhill skiing -- a higher total than any other single industry in the CGYR, except phosphate mining. Indirect plus induced jobs added another 615 jobs in the CGYR.

Big game hunting, with or without outfitters, plays a major role in the creation of jobs in several areas, particularly the Bridger-Teton National Forest and the northern part of the Shoshone National Forest. In contrast, small game hunting produces a total of only 14.8 direct jobs and 11.8 indirect or induced jobs in the entire CGYR.

Fishing activity can be locally important to the economy (see Table 7, p. 41), particularly in the Hebgen Lake Ranger District of the Gallatin National Forest and in the east-flowing streams of the Shoshone National Forest. (See Figure 8.) There are 147 direct jobs related to fishing in the National Forests of the CGYR, and an additional 73 indirect and induced jobs.

Table 7 (p. 41) shows that "Other Recreation" generates a very high number of direct, indirect, and induced jobs in the CGYR. Together, the resorts, campgrounds, and recreation cabin users contribute more to the over all job market in the area than any other single industry which depends directly on Federal lands in the CGYR.

Economic Value

Where available, values are given for economic values of recreational activities. "Economic value", (or "benefit value") as used by the Forest Service, is not a measure of local or regional economic impact. The Forest Service defines this term as a value "to quantify the results of a proposed activity, project or program expressed in monetary or nonmonetary terms."[172] While this definition is not illuminating, in essence it means that the Forest Service attempts to estimate how much each participant values a particular experience. There are a number of methods, chiefly involving surveys of participants, that can be used to estimate such values. These methods might

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[172]U.S. Department of Agriculture, Forest Service. Draft Environmental Impact Statement: 1985-2030, Resources Planning Act Program. Washington, 1984. p. g1-g2.

produce a result showing that, for example, the economic value of a cross-country skiing RVD could exceed the value of a downhill skiing RVD, despite the fact that there are many more downhill skiers or that downhill skiers individually (and of course collectively) spend more money on the activity.

The term "economic value" may appear arbitrary, but the concept has major implications for Forest Service planning, once the value is calculated. The number is used, especially in recreation, to balance in economic terms the various choices facing a manager in the planning process. Effects of activities such as timber harvesting or oil and gas drilling are estimated by multiplying the economic value by the change in output. For example, if an exploratory oil well reduced big game hunting, valued at $30 per Recreation Visitor Day, by 10 RVDs, there is a $300 loss in total big game hunting value due to the drilling. Thus, if the economic value of an activity is low or if the resulting changes are estimated to be small, the effects may be considered insignificant. Table 17 shows the imputed economic values of several categories of recreation in the National Forests of the CGYR.

The Table contains several apparent anomalies. The Bridger-Teton, an area well-known for big game hunting, has exceptionally high values imputed for small game, upland birds, and waterfowl hunting. Similarly, the Targhee and the Caribou report lower values for big game hunting than for other types of hunting. However, the Shoshone, Gallatin, and Custer show just the reverse pattern. No explanation of these and other discrepancies was provided, but it is likely that very different assumptions were used to estimate values in each of the Forests.

The Table shows that imputed economic values for the same activity in adjacent National Forests differ markedly. These differences might result from any of several reasons. Among the likely possibilities is the use of different regional averages for these values. Since three Forest Service regions are represented in the CGYR, different values might be used even if the Forests are adjacent. The disparities in imputed economic values of downhill skiing between adjacent National Forests are particularly puzzling; the reason for these differences is unclear and does not seem to parallel the occurrence of major resorts. They may be due to the use of different regional averages with relatively little local adjustment, or to other unidentified differences in assumptions. To the extent that the Forest Service bases policy on such anomalous data, decisions may appear capricious or incomprehensible until the differences are clarified or resolved.

Economic effects of hiking and camping outside of campgrounds are especially difficult to evaluate, again because of the unusual definitions used by the Forest Service for such terms. The imputed economic value of camping includes both camping in recreational vehicles in campgrounds and in tents in areas far from any road. Wilderness generally has a higher value than hiking or cross-country skiing, but there is no explanation for such discrepancies. There are

TABLE 17. Forest Service Economic Values for Recreational Activities (in dollars per RVD; n/a = not applicable; n/r = not reported)

	Beaver-head NF	Gallatin NF	Custer NF	Shoshone NF	Bridger-Teton NF	Caribou NF	Targhee NF
Year of Data	n/r	1982[1]	1982	1982	1982	1978[2]	n/r[3]
Downhill Skiing	n/a	26.00	26.00	9.97	4.23	n/a	3.00
Camping	3.00	4.00	4.00	9.19[4]	4.23	3.00	3.00
Picnicking	3.00	4.00	4.00	9.19[4]	4.23	3.00	3.00
Hunting:							
Big Game	21.00	28.00	28.00	41.00	35.28	23.10	23.10
Sm. Game	n/r	12.00	12.00	16.00	38.31	26.80	26.80
Gamebirds	n/r	21.00	21.00	24.00	38.31	27.20	27.20
Waterfowl	24.00	21.00	21.00	18.00	45.07	32.00	32.00
Fishing	15.75	9.00	9.00	11.00	24.81	23.10	17.85
Hiking	3.00	7.00	7.00	9.19	4.23	3.00	3.00
X-C Skiing	3.00	7.00	7.00	10.31	4.23	3.00	3.00
Wilderness	8.00	n/r	11.00	12.50	11.20	8.00	8.00

[1]The Gallatin NF did not report year of data for hiking or X-C skiing.

[2]The Caribou NF reported 1981 data for fishing.

[3]The Targhee NF reported 1978 data for downhill skiing and 1983 data for hunting and fishing.

[4]The Shoshone NF supplied a range of values for camping and picnicking, since "Values used in Forest Planning were not broken down distinctly into the listed categories." The values in the table are the low limit; the upper limit is $13.84 per RVD for both categories.

no economic data available from the National Park Service or the Fish and Wildlife Service on these subjects. In general, the Federal agencies charge fees for camping at their developed facilities, although there may not be a fee charged outside of the peak part of the season. The law (16 U.S.C. 460l-6a(b)) requires certain minimum facilities for the agencies to charge such a fee: tent or trailer

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spaces, drinking water, access road, refuse containers, toilet facilities, fire facilities, visitor protection, and personal collection of the fees by an agent of the agency. The campgrounds may have sufficient space for a mere handful to several hundred campsites.

Table 17 shows the imputed economic values of four categories of hunting RVDs. In contrast, the Custer National Forest cited a study by the Montana Extension Service[173] which estimated an expenditure of $1,800 per harvested elk, which would be equivalent to a value far higher than the values shown in the Table, unless the average elk hunter is spending roughly 60 days to harvest one elk (a good illustration of the difference between local expenditures and economic value). For fishing RVDs, the Gallatin National Forest cited two studies[174] in Montana on expenditures by non-resident fishermen. Trout Unlimited reported an average expenditure of $217 per fishing trip by non-residents, and the Madison River Geothermal Study reported $78 per day for non-residents. As with hunting, these reported expenditures differ substantially from the imputed economic values reported by the Forest Service.

There are no data for the economic value of hunting or fishing Recreation Visitor Days on the three National Wildlife Refuges. The Red Rock Lakes and the National Elk Refuge indicated that they do not collect such information; Grays Lake did not respond to the Subcommittees' inquiries.

There are small differences in the imputed economic values reported for summer and winter dispersed recreation. Winter dispersed recreation is rated slightly higher than summer dispersed recreation on some National Forests. These values are shown in Table 18. The reason for the enormous difference between the Bridger-Teton value and the other Forests' values for dispersed recreation is not clear, but may be due to Bridger-Teton's inclusion of such activities as bird-watching and nature photography as dispersed recreation, which other Forests did not include.

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[173]Custer National Forest response to Subcommittees' question 17. Enclosure: French, Roxa. Spotted Knapweed Causes and Effect on Montana Rangelands. Unpublished manuscript, Montana Cooperative Extension Service.

[174]Gallatin National Forest response to Subcommittees' question 16.

TABLE 18. Forest Service Economic Values for Dispersed Recreation (in dollars per RVD; n/r = not reported)

	Date of Estimate	Winter Use	Summer Use
Beaverhead NF	n/r	3.00	3.00
Gallatin NF	n/r	7.00	6.00
Custer NF	1982	7.00	6.00
Shoshone NF[1]	1982	9.19	9.19
Bridger-Teton NF[2]	1982	40.31	40.31
Caribou NF	1978	3.00	3.00
Targhee NF	n/r	3.00	3.00

[1]The Shoshone NF supplied a range of values, since "Values used in Forest Planning were not broken down distinctly into the listed categories." The value in the table is the lower limit; the upper limit was $13.84 per RVD for both winter and summer dispersed recreation.

[2]The Bridger-Teton NF, in its estimate of the economic value of other dispersed recreation in winter and summer, gave the values for "non-consumptive wildlife" use. This category, therefore, includes such activities as bird-watching, nature photography and study, etc.

Effects on Other Resources

Effects on Water Quality

One serious consequence of heavy backcountry use is contamination of water supplies with human and pack animal wastes. (This is an occasional problem at campgrounds, as well.) Of particular concern is human and pack animal fecal contamination, which can spread of the parasite *Giardia lamblia*, and various bacterial contaminants. Contamination by pack animals may also occur. Giardiasis is a waterborne gastrointestinal disease that is rarely fatal, instead leaving many of its victims in temporary but acute misery. Protection is achieved either by boiling water, or by chemical treatment, with one expert recommending both.[175]

As many as 10 percent of the U.S. population may be carriers of giardiasis,[176] so it is reasonable to predict that contamination levels in the CGYR are likely to increase as the number of visitors increases. However, very few studies have been done on the scope of this problem, so current risks in the CGYR cannot be assessed.

[175]Kunkle, Sam. *Giardia* in the Backcountry. Journal of Forestry, v. 83, no. 10 (Oct. 1985): 613.

[176]Kunkle, *Giardia* in the Backcountry. p. 613.

Beaver, elk, sheep, and deer are also hosts, and once the disease is introduced into an area, the presence of these alternate hosts makes it extremely difficult to eradicate. Special attention may be necessary for those watersheds of the CGYR that serve as water sources for surrounding towns, since breakdown of treatment systems has lead to outbreaks of the disease in the past.[177]

Ski developments may also affect water quality. In this respect, they can be similar to timber sales: large patches of bare ground are exposed, and roads are made into remote areas. Traffic on roads can be even heavier, than in timber sales, and both may offer access outside of their season of primary use. (See Effects on Other Resources under Timber Harvesting, p. 49.)

Effects on Wildlife

Developed recreation may disturb or preempt the activities of sensitive species such as grizzly bears, nesting bald eagles and trumpeter swans. Since grizzlies avoid human contact, heavy human use of prime grizzly habitat may drive bears out of an area, unless (in the case of campsites, for example) the bears become accustomed to being fed by humans, raiding garbage cans, or the like. For wildlife generally, roads may interfere with migrations, habitats may become isolated by encircling recreational use, and nesting sites, if continuously disturbed, may be abandoned. For example, concentrated activity (rafting, fishing, boating, etc.) has caused eagles to avoid otherwise suitable habitat along the west side of Yellowstone Lake, the east side of Jackson Lake, and parts of the Snake River basin.[178]

The number of nesting pairs of trumpeter swans inside Yellowstone National Park has dropped from 20 to 10 in the last six years, partly due to human interference at lakeshore nesting sites. Some observers argue that the swans' reproductive success could be improved substantially by creating very small artificial nesting islands in preferred lakes, at locations only a few yards from shore,[179] but the Park Service until recently had a policy of avoiding further manipulation of the environment inside the Park. However, during the fall of 1985, Yellowstone National Park biologists have begun to experiment with artificial nest platforms in four territories that have not fledged

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[177]See, for example: Braidech, Thomas E. and Richard J. Karlin. Causes of a Waterborne Giardiasis Outbreak. Journal of the American Water Works Association (Feb. 1985): 48-51.

[178]The GYE Bald Eagle Working Team. A Bald Eagle Management Plan. p. 16.

[179]Personal communication with Ruth Gale, Biologist, Montana Cooperative Wildlife Research Unit. October 7, 1985.

any young for several years. The effects of these platforms will be monitored for the next several years.[180]

Ski Developments. Due to the mere presence of people, a ski facility may displace animals from critical winter habitat or reduce the suitability of an area for foraging, cover, or travel. Access roads to a facility may increase hunter access, fishing pressure, or numbers of visitors outside of the ski season. The roads could also harm water quality and degrade fisheries habitat. (See Access under Timber Harvesting, p. 49, for further discussion.) The condominium development usually required to make destination resorts profitable can have even wider effects due to increased human activity in the area, both winter and summer. For species such as grizzlies that avoid human contact, the area can be effectively closed to their use. Even less sensitive species, such as elk, can be excluded. An existing ski development -- Big Sky in Montana -- disrupts a Yellowstone National Park elk herd which passes through the area during its migration. However, a Park biologist judged the current effects as minor, if the size of the development does not increase.[181]

The proposed Ski Yellowstone area is the most controversial ski development in the CGYR. It is about 10 miles northwest of West Yellowstone on the north and east sides of Mount Hebgen, and would occupy approximately 1,100 acres of private land and 1,700 acres of National Forest land. It falls within grizzly Management Situation II. (See Map 3 and Map 7.) However, it is near a grizzly bear "black hole" and ranks as "Highest Density" in bear use. (See Map 3 and Figure 4, p. 24.) Ski Yellowstone would also occupy an area currently used as an elk calving ground and would overlap moose winter range and calving grounds.[182]

Ski Yellowstone's developers initially applied for a permit in 1973. A series of appeals have since been filed by opponents, and the developers have submitted additional materials in support of their application. A permit for development was issued by Gallatin National Forest in August 1982. This special use permit does not allow development until a final master plan, construction plans, and financial capability are approved. The Gallatin has asked for additional information regarding Phase I of the development, and does not plan to allow any development to proceed until a Cumulative Effects Analysis of grizzly habitat is complete. The Gallatin reply

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[180]Yellowstone National Park Superintendent Bob Barbee's response to Subcommittees' question 4.

[181]Personal communication with Frank Singer, Wildlife Biologist, Yellowstone National Park. October 7, 1985.

[182]U.S. Department of Agriculture, Forest Service. Proposed Oil and Gas Leasing, Hebgen Lake Ranger District: Environmental Assessment. Bozeman, MT, Gallatin National Forest, 1981. Figure 8.

stated that if the area is reclassified to grizzly Management Situation I, "then alteration of development plans may be necessary."[183] Certain environmental groups have announced plans to sue the Forest Service and the Fish and Wildlife Service concerning the permit.

Ski Yellowstone has bought over 1100 acres of private land (which has appreciated in value due to the proposed development), and has spent approximately $125,000 on a one mile road across private land, as well as about $100,000 in planning costs, according to the Forest Service.[184] Planning and road construction costs and some acquisition costs would not be recoverable if the development does not proceed.

The two proposed ski areas on the Targhee have received little attention. The Sawtell facility is an area of "common sightings" for grizzly bears, while the area near Teton Pass is not considered part of grizzly bear range. (Compare Map 7 and Figure 4, p. 24.) Among the comments on the Targhee draft forest plan, no one supported any of the potential future ski area proposals. However, the Targhee stated its intention to manage the areas so as not to preclude future ski development.[185]

Fishing Bridge. A major controversy also surrounds Fishing Bridge Campground and Visitors Center in Yellowstone National Park. Fishing Bridge is the site of highly developed facilities on the north shore of Yellowstone Lake where the Yellowstone River drains from the Lake. As its name suggests, Fishing Bridge is a favored fishing site, for both humans and grizzly bears. More grizzlies have been removed from this area, either by death or to zoos for control actions than from any other site in the CGYR. (See Map 2.) Largely because of concern for the grizzlies, the National Park Service decided in 1974 to close the 71-year-old facility and move the center of human activity to Grant Village, south of West Thumb, where grizzlies are less common. (See Figure 4, p. 24.) As Grant Village expanded, Fishing Bridge was to be closed.

However, citizens, particularly those in Cody, Wyoming, became concerned that moving the facility would divert traffic and business from the Park's eastern entrance -- through Cody -- to its other entrances. In addition, the Advisory Council on Historic Preservation, a Federal agency, was not consulted on the move, and was concerned about the status of the National Historic District at Fishing Bridge; the Wyoming State Historic Preservation Office shared

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[183]Gallatin National Forest response to Subcommittees' question 20.

[184]Gallatin National Forest response to Subcommittees' question 20.

[185]U.S. Department of Agriculture, Forest Service. Final Environmental Impact Statement for the Land Management Plan for the Targhee National Forest. St. Anthony, ID, 1986. p. 325.

these concerns. As a result of such issues, Fishing Bridge has not been closed.

The area is currently operating under Interim Guidelines.[186] Since 1977, camping at Fishing Bridge has been restricted to "hard-sided" vehicles (recreation vehicles, trucks, station wagons, etc.), to reduce the risk of harm to either species from human-bear encounters. Additional restrictions contained in the interim guidelines include closure of some portions of the campground where grizzly use has been especially high; intense patrolling of the area for garbage; confiscation of unattended food items left within reach of bears; reducing the number of National Park Service employees using cabins; night patrols of campgrounds; and training of National Park Service personnel in bear security. A final Environmental Impact Statement on the closure and relocation is expected in May 1987, with a final decision following in June.

Poaching. The Beaverhead and the Gallatin National Forests identified poaching as a management problem in the CGYR. The Gallatin staff said most poaching (of elk, big horn sheep, moose, deer, and black bears) occurred in Gallatin Canyon.[187] One source asserted that 17 grizzlies have been poached in the CGYR in the last five years.[188] Poaching is particularly damaging for grizzlies, due to the species' low population.

Hunters and Grizzlies. There may be a direct conflict between hunters and grizzlies. Hunter camps may attract grizzlies because of the presence of carcasses and entrails of hunter kills. Grizzlies, with their acute senses of smell, may be able to detect the camps from considerable distances. The area around the Thoroughfare Plateau in the Teton Wilderness has been particularly controversial, since a great deal of elk hunting occurs there in the fall. The very high density of hunter camps, outfitters, and other recreational facilities -- combined with the presence of many well-armed individuals and the elk carcasses -- can lead to shooting of grizzlies attracted to these areas. The Thoroughfare Plateau has been the scene of many bear deaths over the last 10 years. (See Map 2.)

There are stringent regulations in the National Forests of the CGYR for the storage of game meat, fish, and human and animal food.

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[186]U.S. Department of the Interior, National Park Service. Interim Management Plan for Operations at Fishing Bridge and Grant Village. Yellowstone National Park, 1986. 15 p., plus appendices, attachments, and correspondence.

[187]Gallatin National Forest response to Subcommittees' question 17.

[188]Louisa Wilcox, the Greater Yellowstone Coalition, cited in: The Process at Work: Greater Yellowstone. [By Karen E. Franklin.] American Forests (Oct. 1986): 26.

Even so, one observer reported substantial violations of these rules as recently as July 1985; upon complaining to a wilderness ranger, the observer was told that he (the ranger) wanted to issue citations, but had been told not to.[189] The Forest Supervisor subsequently admonished Forest personnel to enforce the regulations more carefully.

Non-Native Species. Introduction of non-native fish to enhance sport fishing is a fairly common practice, but it can be harmful to other species. Recently, an ecological mishap was barely averted when Eastern brook trout were discovered in a tributary of Yellowstone Lake.[190] The Lake currently contains a large population of Yellowstone cutthroat trout, which spawns in the spring. Where brook trout have been introduced elsewhere, they quickly out-compete cutthroat trout: young cutthroats become food for the introduced brook trout. Since the spawning cutthroats are a critical spring food source for such species as grizzly bears and bald eagles, their loss due to displacement by the fall-spawning brook trout would have harmed many other species of animals. The U.S. Fish and Wildlife Service quickly poisoned both Arnica Creek and part of West Thumb where the introduced species was found, killing thousands of fish at a cost of about $25,000. The Park Service is offering a reward of $1,000 for information leading to the arrest of the offender -- thought to be a fisherman who deliberately introduced a bucket of fish into Arnica Creek.[191]

Effects on Other Resources

Some recreational users may oppose timber sales, leasing activities, or grazing, as an interference with their use of an area. Other users may not object to, or may even welcome such use, as it increases their access to otherwise inaccessible areas. (See Effects on Recreation under Timber Harvesting, p. 51.)

Fear and Protection. Conventional wisdom holds that one effect of hunting is the possible discouragement of use by non-hunting visitors who might hesitate to enter an area because of their fear of accidental shooting, particularly during the hunting season for large mammals. (Surprisingly, an intensive search failed to discover any studies in any geographic area that might either affirm or quantify or

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[189]Correspondence between Mr. Tom McNamee and Bridger-Teton National Forest Supervisor. Five letters and memos dated between Sept. 5, 1980, and Sept. 26, 1985. Furnished by Forest Service Chief R. Max Peterson on March 16, 1986, to Chairman Seiberling.

[190]Eastern Trout Threaten Species in Yellowstone. New York Times. Sept. 26, 1985. p. B13.

[191]Eastern Trout Threaten Species in Yellowstone. New York Times. Sept. 26, 1985. p. B13.

refute this observation.[192]) Loggers may also be reluctant to enter an area during a hunting season for similar reasons.

A Yellowstone National Park document sounds the following warning: "The hazard of a bear encounter is low, but very real. If you cannot accept the possibility of an encounter, then hike elsewhere."[193] Martinka[194] has shown that, at Glacier National Park, human-grizzly confrontations and grizzly bear removals are strongly correlated with visitation rates. He argues that traditional management of confrontations has "stressed the aggressive treatment of problem bears," rather than "visitor management, as an independent variable, [holding] the key to reducing future confrontations and bear removals in the park environment." Since reductions in the total numbers of visitors are unlikely or even impossible, he emphasizes control of visitor distribution. Among his listed options are the following:

1. Relocation of trails and campsites;
2. Restriction of human activity in an area to times or seasons when grizzlies are unlikely to be present; and
3. Use of computer models with detailed information on visitor travel patterns, campsite use, and bear contacts.

These options are obviously not mutually exclusive. Moreover, the last option could consider far more variables than those cited by Martinka as predictors of grizzly bear confrontations. It is clear, however, that unless data bases are improved beyond those made available for this study, the computer modeling option at Yellowstone National Park is highly improbable at this time due to lack of even raw data on recreation use, rainfall, bear sightings, and bear movements, among other important factors. (See also the following chapter on grizzly bear mortalities.)

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[192]Personal communication with Donald B. K. English, Outdoor Recreation Planner, Southeast Forest Experiment Station, U.S. Forest Service. October 21, 1986.

[193]U.S. Department of the Interior, National Park Service. Beyond Road's End: A Backcountry User's Guide to Yellowstone National Park. 1981. p. 17.

[194]Martinka, C. J. Rationale and Options for Management in Grizzly Bear Sanctuaries. Transactions of the Forty-seventh North American Wildlife and Natural Resources Conference. Washington, Wildlife Management Institute, 1981. p. 470-475.

CULTURAL AND HISTORIC RESOURCES

Although this report is primarily focused on the natural resources of the Yellowstone ecosystem, the cultural and historic resources of the area can also affect and be affected by human development activities. This chapter provides a description of what was reported to the Subcommittees about the historic and cultural resources in the CGYR. The major finding is that there is little information about the locations and importance of the cultural and historic resources in the area.

INFORMATION ON THE RESOURCES

Prehistoric and historic sites occur throughout the CGYR. Prehistoric sites are areas with relics which predate written history, such as burial grounds, cairns, petroglyphs (rock art), paleontological sites, and bone beds of bison and antelope. Historic sites include more recent sites that still have importance for understanding the area's history, such as structures associated with past mining activity and Native American Indian settlements. Parts of the area are also used by Native Americans for cultural and religious purposes.

Yellowstone National Park contains numerous cultural and historic sites. There are two historic districts (Fishing Bridge and Old Faithful), five individual structures, and one archeological site in the National Register of Historic Places for Yellowstone National Park, and three historic structures listed for Grand Teton National Park.[195] There has also been a cultural site inventory for Yellowstone,[196] which identified 279 cultural sites in the Park; of these, 232 sites are in Wyoming and 47 are in Montana, with none in Idaho.[197] However, the inventory noted that more than 90 percent of the Park lacked a systematic survey of cultural resources, and it was "not

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[195]Personal communication with National Register Office, Cultural Resources Division, National Park Service, U.S. Department of the Interior. December 5, 1986.

[196]Yellowstone National Park response to Subcommittees' questions. Enclosure 25: U.S. Department of the Interior, National Park Service, Midwest Archeological Center. Cultural Site Inventory of Yellowstone National Park. Lincoln, NE, Oct. 1984. 23 p.

[197]Cultural Site Inventory of Yellowstone National Park. p. 9.

possible to predict the extent of archeological resources within Yellowstone National Park."[198]

The National Forests in the CGYR also contain numerous historic and prehistoric sites. Table 19 shows the number of sites identified by each National Forest, with data disaggregated by Ranger District where provided in such detail. Of these nearly 1,000 sites, nine are listed on the National Register of Historic Places, including two on the Beaverhead National Forest, four on the Shoshone National Forest, and three on the Bridger-Teton National Forest.[199] In addition, the administrative sites of the Targhee and Caribou Forests and the Oregon and Lander Trail segments that cross the Caribou are eligible for listing on the National Register.[200]

Despite this listing of historic sites in the National Forests, the information on such sites is far from comprehensive. The State Historic Preservation Office for all three States described the incomplete records on cultural sites in the National Forests. The Idaho State Historical Society stated that "A majority of prehistoric sites on the Caribou National Forest have yet to be located since little cultural resource survey has occurred there."[201] Further, "Historic resources, in fact, appear to be the best-kept secret of the Forest Service. Unlike other issues which are discussed and debated, the issue of historic resources is virtually ignored."[202] Finally, the Wyoming State Archives, Museums, and Historical Department stated that "most of the area delineated [by the CGYM] for Wyoming has never been surveyed for cultural resources."[203] Thus, the existing information on cultural and historic resources in the National Forests is not complete.

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[198]Cultural Site Inventory of Yellowstone National Park. p. 6.

[199]Personal communication with National Register Office, Cultural Resources Division, National Park Service, U.S. Department of the Interior. December 5, 1986.

[200]Idaho State Historical Society, State Historic Preservation Office, response to Subcommittees' questions. p. 1.

[201]Idaho State Historical Society, State Historic Preservation Office, response to Subcommittees' questions. p. 1.

[202]Montana Historical Society, State Historic Preservation Office, response to Subcommittees' questions. Enclosure: Letter from Martha Claire Catlin, Consultant, American Cultural and Architectural History, to Robert Breazeale, Gallatin National Forest Supervisor, August 12, 1985. p. 2.

[203]Wyoming State Archives, Museums and Historical Department, State Historic Preservation Office, response to Subcommittees' questions. Cover letter.

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TABLE 19. Number of Historic and Prehistoric Sites in the National Forests of the CGYR

NATIONAL FOREST Ranger District	Number of Historic Sites	Number of Prehistoric Sites
BEAVERHEAD NF	10	18
Gravelly Subd.	3	6
Madison Subd.	0	5
Tobacco Root Subd.	7	7
GALLATIN NF	Total of 300 "cultural sites"	
CUSTER NF	2	2
Beartooth Subd.	2	2
SHOSHONE NF	51	79
Clarks Fork RD	23	27
Wapiti RD	8	15
Greybull RD	7	8
Wind River RD	7	16
Lander RD	6	13
BRIDGER-TETON NF	73	145
CARIBOU NF	46	0
TARGHEE NF	83	157
Island Park RD	20	52
Ashton RD	23	40
Teton Basin RD	20	33
Palisades RD	20	32

Despite this listing of historic sites in the National Forests, the information on such sites is far from comprehensive. The State Historic Preservation Office for all three States described the incomplete records on cultural sites in the National Forests. The Idaho State Historical Society stated that "A majority of prehistoric sites on the Caribou National Forest have yet to be located since little cultural resource survey has occurred there."[204] Further, "Historic resources, in fact, appear to be the best-kept secret of the Forest Service. Unlike other issues which are discussed and debated, the issue of historic resources is virtually ignored."[205] Finally,

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[204]Idaho State Historical Society, State Historic Preservation Office, response to Subcommittees' questions. p. 1.

[205]Montana Historical Society, State Historic Preservation Office, response to Subcommittees' questions. Enclosure: Letter from Martha Claire Catlin, Consultant, American Cultural and Architectural

the Wyoming State Archives, Museums, and Historical Department stated that "most of the area delineated [by the CGYM] for Wyoming has never been surveyed for cultural resources."[206] Thus, the existing information on cultural and historic resources in the National Forests is not complete.

PROTECTION OF THE RESOURCES

Federal agencies are responsible for preserving historic properties which they own or control. The National Historic Preservation Act directs the agencies to consult with the Secretary of the Interior and with State historic preservation officers in locating historic sites and recommending qualified sites for the National Register.

There has been some coordination among the Federal agencies for preserving historic sites in the CGYR. The Advisory Council on Historic Preservation (ACHP) reported 61 cases of consultation since 1972, principally with the National Park Service and the Forest Service, although they noted that their records may be incomplete for the older cases.[207] One case of particular note is the Fishing Bridge Historic District in Yellowstone National Park. Beginning in 1974, the National Park Service has considered removing the buildings and returning the area to its natural state, because of the numerous confrontations between humans and grizzly bears. (See Grizzly Bear Mortality Clusters: A Site-Specific Analysis.) The Wyoming State Historic Preservation Office asserted that the area would qualify for the National Register of Historic Places, and the ACHP became involved in the disputed building demolition in 1980.[208] The National Park Service program to close Fishing Bridge was halted in 1983, but the agency has begun a new planning effort to reconsider closing the area.

The Council also felt that they were not consulted in all relevant Federal projects, particularly in the National Forests; specifically:[209]

History, to Robert Breazeale, Gallatin National Forest Supervisor, August 12, 1985. p. 2.

[206]Wyoming State Archives, Museums and Historical Department, State Historic Preservation Office, response to Subcommittees' questions. Cover letter.

[207]Advisory Council on Historic Preservation response to Subcommittees' questions. 9 p.

[208]Advisory Council on Historic Preservation response to Subcommittees' question. p. 4.

[209]Advisory Council on Historic Preservation response to Subcommittees' questions. p. 8.

> Given the extent of timber sales, recreational developments, road construction and improvements, and other usual Forest Service activities, it would appear that many undertakings are occurring without offering the Council an opportunity to comment under the provisions of the National Historic Preservation Act.

The Forest Service is developing integrated land and resource management plans for the National Forests, but surveys of cultural and historic resources are generally only conducted on specific sites for each proposed project; oil and gas leases, for example, include a stipulation requiring a survey for paleontological resources. Initially, the Advisory Council on Historic Preservation concurred with the Forest Service that the Forest plans would have no effect on historic properties, and had ratified a Programmatic Memorandum of Agreement allowing plan development without comments from the Council.[210] However, the State Historic Preservation Offices have recognized that the Forest plans may provide for activities without adequately considering historic resources; the Montana Historical Society, for example, stated that:[211]

> . . . we strongly question whether the Forest Service can undertake "a systematic program of cultural resource inventory, evaluation and preservation aimed at the enhancement and protection of significant cultural resource values" in the absence of a full-time cultural resource staff specialist. Indeed, several years [sic] work by seasonally employed technicians has apparently not provided sufficient information on cultural resources to contribute to the planning alternatives of the draft [Forest plan].

The Advisory Council has since recognized that the Forest plans may allow activities without adequate cultural and historic resource protection, and is therefore currently negotiating a new agreement with the Forest Service.[212]

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[210]Advisory Council on Historic Preservation response to Subcommittees' questions. p. 9.

[211]Montana Historical Society, State Historic Preservation Office, response to Subcommittees' questions. Enclosure: Letter from Alan L. Stanfill, Archaeologist/Anthropologist, Montana Historical Society, to Beaverhead National Forest Supervisor, January 16, 1985. 1 p.

[212]Advisory Council on Historic Preservation response to Subcommittees' questions. p. 9.

EFFECTS ON OTHER RESOURCES

Cultural and historic resources, in and of themselves, have little effect on the ecosystem. They can, however, affect development activities by restricting activities in some areas. There are several ways in which protecting historic and cultural resources may alter human activities. The most common impact is stopping activities in certain areas; for example, the Bureau of Indian Affairs noted that operations which uncover archeological sites in the Wind River Indian Reservation are halted, with undamaged sites left *in situ*, while damaged sites are removed.[213]

Cultural and historic sites may also need to be protected from natural processes. Normal weathering and natural catastrophes can damage these sites. For example, the Forest Service has developed a policy of not suppressing some wildfires, under prescribed conditions, to restore some of the natural ecological processes; however, an internal Wyoming State Historic Preservation Office memorandum suggested that this policy could damage historic resources, and fire management plans should be modified to protect these sites.[214]

Finally, the designation of an historic site could increase the attraction of the area, possibly increasing the need to protect the site. In addition, increased recreation visits can influence land and resource management decisions, in much the same manner as other types and sites for recreational activities. Thus, protecting and designating cultural and historic sites could affect other resource uses. (See Effects on Other Resources under Recreation, p. 101.)

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[213]Bureau of Indian Affairs response to Subcommittees' question 2.

[214]Wyoming State Archives, Museums and Historical Department, State Historic Preservation Office, response to Subcommittees' questions. Enclosure: Memorandum from Richard Bryant, Compliance Archeologist, to Mark Junge, Chief, April 26, 1984.

GRIZZLY BEAR MORTALITIES: A SITE-SPECIFIC ANALYSIS

Forest Service consideration of local fauna in land management planning relies on the concept of "indicator species." The rationale for this concept is that, by assuring the well-being of the indicator species' population, the health of its ecosystem will protected. Thus, measuring the condition of the indicator species in the CGYR serves as a surrogate for the much more difficult measurement of the condition of the whole ecosystem. The grizzly is a particularly appropriate indicator species for the Yellowstone ecosystem for several reasons: (1) its important habitats are also important to many other species; (2) grizzlies are sensitive to human intrusion; and (3) grizzlies often die in human-bear encounters.

Maintaining adequate populations of this grizzly bears depends on at least two major factors: the rate at which new bears are born, and the rate at which bears die. Both of these rates are, of course, affected by a host of other variables. Human actions affect the bears' birth rates indirectly, by modifying -- or not modifying -- grizzly habitat, in a manner that is difficult to measure, and which makes it difficult to identify which bears will benefit. (See Chapter III: Development Activities for a discussion of these effects.) In contrast, bear mortalities caused by humans leave individual bears as victims. As noted earlier, the loss of adult female bears is particularly critical, since the loss of one or two adult females per year to this population constitutes the difference between a declining and a stable or expanding population. In other words, if the average loss of adult females from the ecosystem can be reduced by only one or two per year, the population will likely recover, though perhaps slowly. If not, it will become extinct.

The following discussion analyzes current information concerning this indicator species, and its mortalities. The discussion considers particularly the clusters of mortalities and the locations and causes of deaths within these clusters. There are several major conclusions.

1. Data on grizzly mortalities are of unusually poor quality, and discrepancies in agency records are abundant. No single collection point exists, and agencies gather different kinds of information about deaths.

2. While no single, over-riding cause exists for the bears' population decline, the data reveal patterns in the causes of bear deaths at some mortality clusters. These causes may be preventable.

3. The Situation Management concept currently used by the agencies is not a useful management tool for preventing deaths of grizzly bears.

SOURCES OF INFORMATION

Several Federal and State agencies were questioned on locations of grizzly bear mortalities occurring between 1976 and 1985. The Fish and Wildlife Service, which has the responsibility of enforcing the Endangered Species Act, did not have any locality data for deaths before 1983, and the data provided for 1983-1985 was not sufficient to map locations; the agency replied that it did not maintain such specific information.[215]

The data from the State of Wyoming and from the Interagency Grizzly Bear Committee (IGBC) were sufficiently clear and thorough to permit analysis. Wyoming provided a map showing the entire CGYR, with the location and year of each mortality, and a table showing the numbers of deaths due to various causes.[216] The IGBC provided a table with information about each dead bear, a site (usually by township, range, and section), and some brief description of cause of death.[217] Some inconsistencies should be expected when comparing hand-drawn maps with legal site descriptions. However, the extent of the discrepancies in this case is surprisingly large and reflects serious problems in the reporting techniques, especially since this information was the best available from the various sources. Moreover, these two sources rarely agreed with other, less comprehensive sources. Examples of discrepancies include:

1. Deaths identified as occurring at a certain creek or mountain in a given township, range, and section, when no such feature occurred in that section (and, in one case, was found in another State);

2. Deaths listed by one agency miles from any possible match with data supplied by other agencies.

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[215]Fish and Wildlife Service response tc Subcommittees' questions. p. 11.

[216]State of Wyoming response to Subcommittees' questions. Map of Grizzly Mortalities, and p. 3 of Terrestrial Resources section. There was no information on how the data were obtained, but the memo implies that the State keeps its own records on grizzly deaths.

[217]Memorandum from Glen Contreras, Manager, Threatened and Endangered Program, U.S. Forest Service, Ogden, Utah, to Interagency Grizzly Bear Committee. June 19, 1986. 6 p. Prepared at IGBC request. The data were collected from internal IGBC documents and through telephone calls to unspecified sources.

The table below illustrates the data problem when examining grizzly mortality by comparing attributed causes of death from two sources. The State of Wyoming provided data on grizzly deaths from 1976-1985, showing 18 deaths from natural causes, and 94 human-caused deaths, for a total of 112 deaths. The Interagency Grizzly Bear Committee (IGBC) reported only 63 deaths from the period, not including any from natural causes. As indicated in Table 20, there was substantial, but not perfect, agreement on the number of deaths due to road kills, research or management accidents, and unknown causes. But Wyoming reported nearly three times as many illegal kills, with illegal kills accounting for 64 percent of all grizzly mortality in the last decade. The IGBC reported more deaths due to management controls[218] and self defense/property protection, with illegal kills totalling only 33 percent of reported grizzly mortality. On the other hand, the IGBC memo asserted that in some areas (specifically in the Shoshone National Forest in Wyoming), there was duplicate counting of deaths. Moreover, the discrepancies may be even greater than the table suggests, since the IGBC list classified several deaths under the most probable cause, rather than as "unknown."

TABLE 20. Mortality Causes for Grizzly Bear Deaths in the Yellowstone Area from 1975-1985

As reported by the State of Wyoming (from July 18, 1986, reply by State of Wyoming to Subcommittee inquiry) and by the Interagency Grizzly Bear Coordinating Committee (Memo from Glen Contreras, Threatened and Endangered Program Manager to IGBC, dated June 19, 1986).

Mortality Cause	State of Wyoming Number Recorded	IGBC Number Recorded
Management Control	18 (19%)	22 (35%)
Research/Management Accident	6 (6%)	7 (11%)
Road Kill	5 (5%)	5 (8%)
Self Defense/Property Protection	2 (2%)	6 (10%)
Illegal	60 (64%)	21 (33%)
Unknown	3 (3%)	2 (3%)
Total	94	63

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[218]"Management Control" refers to the deliberate killing or removal of bears from the ecosystem. (From the standpoint of the recovery of the bear population, removed bears are equivalent to dead bears.) "Research/Manage- ment Accident" includes bears which die during attempts to put collars or tags on them or which are accidentally killed when, for example, being moved to a more remote area.

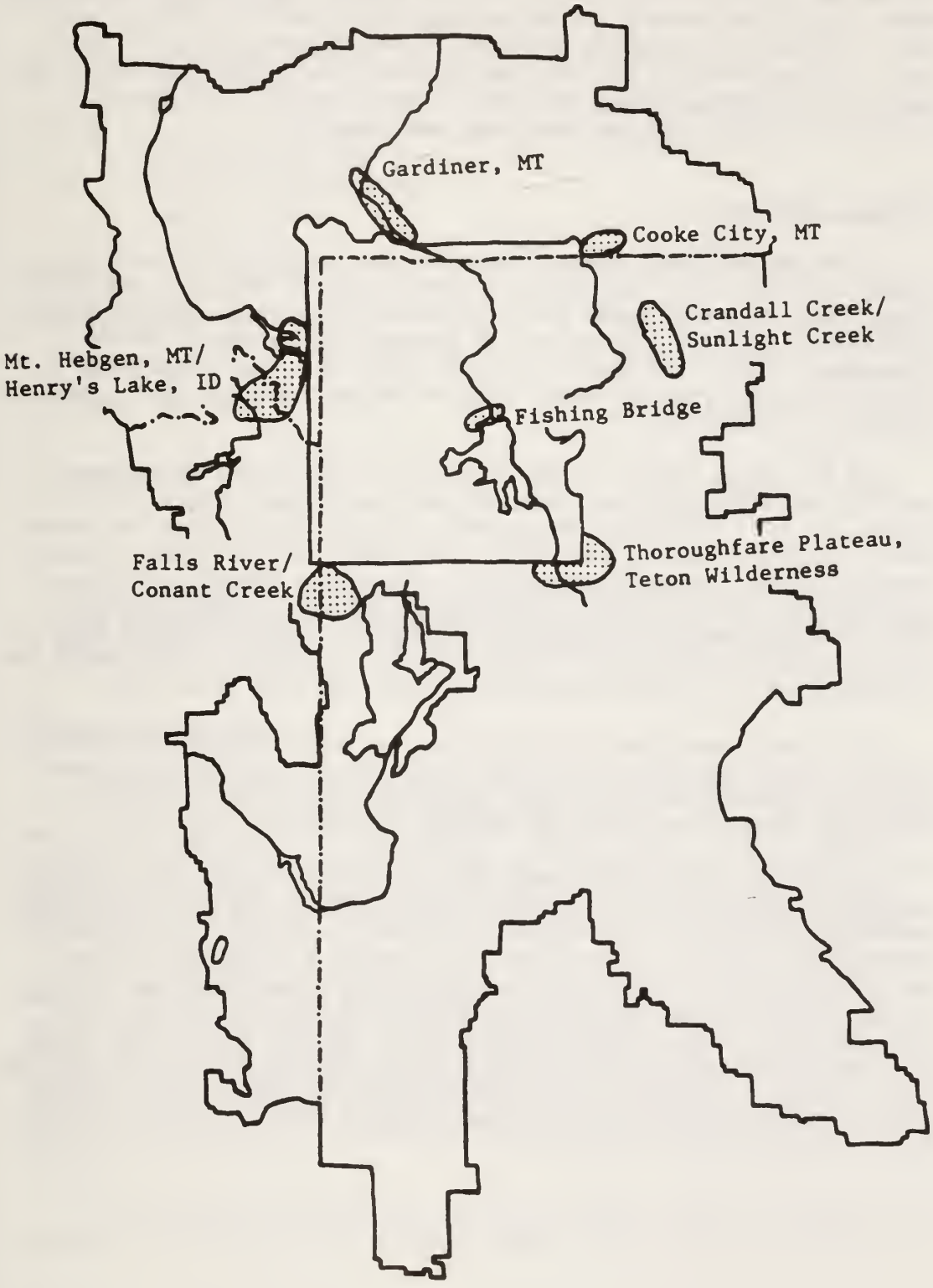
The IGBC memo makes it clear that the data were compiled hurriedly and thus, some mistakes should be expected. The IGBC memo's author recognizes the incompleteness and the discrepancies of various agencies' records, and advocates preparation of a fuller, more nearly complete list. The truly surprising finding is that such information was not already accessible to the IGBC -- which is charged with coordinating the recovery of this population -- before Congressional inquiries began.

There was considerable difficulty in reconciling the site-specific information from the State of Wyoming with that of the IGBC. For example, the State of Wyoming reported at least seven deaths near the Thoroughfare Plateau in the Teton Wilderness of the Bridger-Teton National Forest which were apparently unknown to the IGBC. A death reported by the State of Wyoming near Baldy Mountain in the Palisades Ranger District of the Targhee NF was not reported by the Targhee. The methods used in this analysis may even understate the differences: a match between Wyoming and IGBC reports was assumed if the deaths were in the same general area (within about five miles) and in the same year; larger deviations were considered matches, if other factors, such as location on a certain stream, were the same. However, there were still considerable discrepancies. Thus, the number of matches listed in the discussion below is probably a maximum -- and the number of reported bear deaths therefore a minimum -- unless one of the reports includes more deaths that there actually were. Using the standards just described, there were seven areas within the CGYR that appeared to have clusters of mortalities. (See Figure 10.)

Policy makers are also handicapped by lack of data on reasons for "management control" deaths, which accounted for 19 percent of the grizzly mortalities reported by Wyoming and 35 percent of those reported by the IGBC. A manager wishing to reduce human/grizzly conflict is left with little useful data upon which to base management decisions if the reason for the management control is omitted from the record. Management decisions might be quite different if, for example, the cause of past management controls was the habituation of bears to human handouts or animal carcasses by outfitters, rather than the presence of confirmed sheep-killers. However, from the standpoint of the grizzly population, it is irrelevant how a bear was removed from the ecosystem: by death (shooting or drug overdose) or alive (removal to a zoo or to British Columbia), and such information may be less important to managers.

In short, the best available data on grizzly mortalities are incomplete, contradictory, and do not provide sufficient information for informed decisions. Moreover, the tenure of managers in the Forest Service, Park Service, or Fish and Wildlife Service may be quite short. Thus, relying primarily on memory and personal familiarity with an area is insufficient for assuring recovery of the grizzly population.

FIGURE 10. Seven Grizzly Bear Mortality Clusters in the CGYR. Mortality Clusters Based on Data from State of Wyoming response to Subcommittees' Questions (including Wyoming Map of Grizzly Mortalities), and on Memo from Glen Contreras, Manager, Threatened and Endangered Program, U.S. Forest Service, Ogden, Utah, to Interagency Grizzly Bear Committee. June 19, 1986. Prepared at IGBC request. 6 p. (Unnumbered internal document.)



GRIZZLY BEAR MORTALITY CLUSTERS

Despite the weaknesses and discrepancies in the data, grizzly mortalities over the last 10 years show concentrations in seven areas in the CGYR. These areas are therefore sites where activities by humans are having demonstrated effects on the natural ecosystem. The following discussion describes the bear deaths, and briefly discusses known activities which might affect the likelihood of grizzly recovery. Failure to discuss a particularly development activity means that no major conflict between that activity and grizzly survival was known by the Subcommittees to occur: there may be development conflicts of which the Subcommittees are unaware.

Gardiner, Montana

Three deaths were reported in this area by both the State of Wyoming and the IGBC, and four additional deaths were reported by the IGBC. Most of these deaths are in the zone classed as grizzly bear Management Situation II, but one is outside the Situation areas altogether. This last death, in 1982, area of "common sightings", while the others were in either high or highest density use. (See Figure 4, p. 24.)

Of the seven IGBC-reported deaths, one was a 1982 management control near Crystal Cross Mountain, with no reason given. Two others, in 1983, were also management controls (again with no reason given), at the Gardiner town dump. Two deaths (in 1977 and in 1979) were management controls taken because of cattle predation. (These were the only two management controls listed in the IGBC memo for which a reason was clearly stated.) In 1981, a grouse hunter was attacked and killed a bear in self-defense. Finally, a 1981 death was an illegal kill in which the bear was shot and left on a road.

The area downstream from Gardiner, along the Yellowstone River, provides important habitat for both bald eagles and trumpeter swans. It is also heavily used for sport fishing. The entire area is important winter range for the northern Yellowstone elk herd.

There are some heavy insect infestations of timber near Gardiner, suggesting possible future Forest Service timber sales to control the outbreak. Most of the infestations are at least five miles from past mortalities, but one is near the 1982 site of a management control, and the Gallatin National Forest is planning a logging operation very close to, if not on, this site. There is an oil and gas lease at Sheep Mountain, about eight miles from the nearest grizzly mortality, and another lease near Steamboat Mountain, roughly four miles from the 1982 mortality. However, there are no wells at either site. There has been extensive mining and prospecting in the area around Gardiner and the nearby town of Jardine.

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TABLE 21. IGBC Data on Grizzly Mortalities Near Gardiner, Montana (* - judged to be a match with data provided by State of Wyoming.)

Date	Location	Sex	Age	Remarks/Collar Number
6/22/83	T9S, R8E, Sec.16 (Town Dump)	M*	1	Mgmt. control
5/22/83	T9S, R8E, Sec.16 (Town Dump)	F*	12	Mgmt. control
7/29/82	T7S, R6E, Sec.27 (Reported as T6S, but site on Miner Creek requires T7S)	F	2	Mgmt. control
10/16/81	T9S, R8E, Sec.5	F*	22	Illegal, shot
9/13/81	T8S, R9E, Sec.31	F	8	Self-defense: grouse hunter charged
10/19/79	T8S, R7E, Sec.20	M	7	Mgmt. control: cattle predator
9/20/77	T8S, R7E, Sec.21	M	11	Mgmt. control: cattle predator

With no further information on the reasons for the three unexplained management controls or the illegal shooting, it is difficult to generalize about the human/bear conflicts around Gardiner.

Cooke City, Montana

There have been eight grizzly deaths in the Cooke City area in the last 10 years. Seven deaths were reported by the State of Wyoming and six by the IGBC, with an apparent agreement on five of these deaths. Some of the deaths in this area occurred in Situation I and others in Situation II. The area is classified partly as highest density use and partly as common sightings. (See Figure 4, p. 24.)

The IGBC provided records for a total of six of these eight deaths. Three of these were management controls, with no reason given. Three were illegal, with corpses found in 1976, 1978, and 1981. Two of these were left at the town dump, and one was found on a moose carcass. (Whether the moose had been attacked and killed by the bear or whether the moose was a hunter's kill was not stated.) Two of these kills occurred in September, and for the third the date was unknown.

The Gallatin National Forest plans timber sales in an area that has been the site of several bear deaths, and is near the site of

several additional deaths. There are some mines in the general area, and the USGS reported that the Cooke City area was once a important mining area, and continues to be a major reserve of metals. Zinc is produced at some of the mines.[219]

TABLE 22. IGBC Data on Grizzly Mortalities Near Cooke City, Montana (* = judged to be a match with data provided by State of Wyoming; ? = information not known or not provided by IGBC memo.)

Date	Location	Sex	Age	Remarks/Collar Number
8/5/85	Silver Gate	F	4	Mgmt. control, #67
7/31/82	T9S, R14E, Sec.25	F*	15	Mgmt. control
7/31/82	T9S, R14E, Sec.25	M*	14	Mgmt. control
9/9/81	T9S, R15E, Sec.18	M*	5	Illegal, shot on moose carcass
?/?/78	T9S, R15E, Sec.31	M*	3	Illegal, shot, left at dump
9/27/76	T9S, R14E, Sec.25	M*	4	Illegal, shot at dump

(2 additional deaths reported by State of Wyoming in this area)

With no further information on the reason for the three unexplained management controls, it is difficult to generalize about the human/bear conflicts around Cooke City, but it seems that illegal kills may be an important problem in this area.

Crandall Creek/Sunlight Creek, Shoshone National Forest, Wyoming

There appear to have been nine grizzly deaths in the Crandall Creek/ Sunlight Creek area of the Shoshone National Forest over the last 10 years, according to the State of Wyoming, but only two were reported by the IGBC. Most occurred in Situation I, although a few were in Situation II. The area is ranked largely as high or highest density use. (See Figure 4, p. 24.)

In 1982, a bear was shot illegally, while a 1984 kill is still under investigation. Wyoming reported three deaths around Sunlight Creek plus two deaths in the Crandall Creek area for 1982, but the IGBC memo notes that there may be some duplicate counting (without

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[219]U.S. Geological Survey response to Subcommittees' questions. Maps of mines and metallic resources.

naming the State of Wyoming or any other party) of 1982 deaths in the Shoshone National Forest.

Forest Service managers identified Sunlight Creek as a heavily used sport fishery.[220] A study of a nearby area (the Clark's Fork drainage) showed that grizzly use was seasonal, with most of the use in spring and fall, and that these bears also used the Crandall Creek area.[221] The study also showed that the Clark's Fork area is important to moose, and that grizzlies prey upon these moose during the fall. Sunlight Creek is also the site a long-standing proposal by the Bureau of Reclamation for a hydroelectric dam. This proposal has never been authorized or funded, but its implementation and the attendant increase in human activity could pose a threat to resident bears.

If the IGBC is correct, and the Wyoming map contains a substantial number of duplications, this area might be less important in overall grizzly mortality. The 1982 death listed in the table below, plus another to the south, were the only ones reported by the IGBC in the Shoshone National Forest for 1982. In contrast, the Shoshone National Forest listed (without giving location) four deaths in 1982 from poaching and one from unknown causes.[222] Given this particularly confusing situation, it is difficult to generalize about the human/bear conflicts in this area, but it is possible that illegal kills are a problem in this area.

TABLE 23. IGBC Data on Grizzly Mortalities Near Crandall Creek and Sunlight Creek, Shoshone National Forest, Wyoming
(* = judged to be a match with data provided by State of Wyoming; ? = information not known or not provided by IGBC memo.)

Date	Location	Sex	Age	Remarks/Collar Number
8/?/84	T56N, R108W, Sec.10	?*	Sub-adult	Unknown, collar #108
6/?/82	T55N,R106W,Sec.34	M*	4	Illegal, shot

(7 additional deaths reported by State of Wyoming; IGBC suggests some duplicate counts)

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[220]Shoshone National Forest response to Subcommittees' question 16.

[221]Reid, Matthew M. and Steven D. Gehman. A Common Sense Approach to Grizzly Habitat Evaluation. In Proceedings -- Grizzly Bear Habitat Symposium. Forest Service Technical Report INT-207. Ogden, UT, U.S. Department of Agriculture, May 1986. p. 93.

[222]Shoshone National Forest response to Subcommittees' question 18.

Thoroughfare Plateau, Teton Wilderness, Wyoming

There appear to have been 12 deaths in the Thoroughfare Plateau area in the last 10 years. Eleven deaths were reported by the State of Wyoming, while four of these were also reported by the IGBC. The entire area is Situation I, and Knight and Eberhardt classify it as high or highest density use. (See Figure 4, p. 24.)

Even with the limited IGBC data available, there is a pattern of shooting deaths: all four of the IGBC-reported deaths are related to illegal shootings. Indeed, this pattern is supported by three additional grizzly shootings in area to the southwest of the plateau, farther along the elk migration route toward the National Elk Refuge. All three of these grizzly deaths are also illegal and hunter-related, according to the IGBC.

The Thoroughfare Plateau experiences intense hunting pressure on the elk migrating from their summer range in Yellowstone National Park to their winter range in and near the National Elk Refuge. The upper Yellowstone River flows through this area, and the fish resources of the River and the surrounding lakes provide food for bald eagles. The area is an important nesting area for bald eagles as well as trumpeter swans. Forest Service managers rated both Thoroughfare Creek and this part of the Yellowstone River as heavily used by sport anglers.[223]

Of the seven grizzly bear mortality clusters described in this report, this one shows perhaps the clearest pattern of mortality causes: all of the mortalities are related to firearms, hunters, or outfitters. There have already been complaints about lax Forest Service enforcement of regulations concerning outfitters and hunters in this area (see Effects on Other Resources under Recreation, p. 101), and such efforts need strengthening, if they have not been improved as yet.

Fishing Bridge, Yellowstone National Park, Wyoming

There appear to have been 10 deaths in the area around Fishing Bridge in the last 10 years. Nine were reported by the State of Wyoming, and five by the IGBC, with apparent agreement on four of these deaths. In this area, the Park Service has created some Situation II islands in an area that is otherwise Situation I. With the scale of maps available, it is impossible to determine whether the deaths occurred in Situation I or II. Indeed, the very small size of these Situation II areas is not meaningful in terms of grizzly movements. Rather, they reflect the decision of National Park Service management that the high concentration of human use shall take priority over the high concentration of grizzly use: the entire area ranks as highest density bear use. (See Figure 4, p. 24.)

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[223]Bridger-Teton National Forest response to Subcommittees' question 16.

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TABLE 24. IGBC Data on Grizzly Mortalities Near the Thoroughfare Plateau, Teton Wilderness, Bridger-Teton National Forest, Wyoming (* = judged to be a match with data provided by State of Wyoming; ? = information not known or not provided by IGBC memo.)

Date	Location	Sex	Age	Remarks/Collar Number
7/?/85	T48N, R109W, Sec.8	F*	?	Illegal, shot
11/3/81	T48N, R110, Sec.16 Hawks Rest, Camp Burdette (reported as R108W, but should be R110W)	M*	3	Illegal, at outfitters camp
9/16/80	Schmaltz Camp, Pass Creek	M*	13	Illegal, mistaken identity
9/26/77	Phelps Pass	F*	16	Illegal, at hunter's camp
(7 additional deaths reported by Wyoming)				

The IGBC reported all five deaths as management control actions (or similar terms), without elaboration. Although some explanations for these actions can be ruled out by the setting (e.g., conflicts with grazing and hunters), it is not possible to draw specific conclusions about the cause (or need for) management control from this record.

The area in and around Fishing Bridge provides food and nesting sites for both bald eagles and trumpeter swans. Visiting cranes from the Grays Lake experimental flock (the first whooping cranes in the Park in decades) were seen in this area in 1985. As the name Fishing Bridge suggests, Yellowstone Lake and the Yellowstone River both experience very intense fishing pressure.

Recreational development is highly concentrated around Fishing Bridge, including numerous campsites, picnic areas, boat docks, two amphitheaters, two stores, two restaurants, a shower and laundry, two lodges, a post office, two gas stations, and a ranger station. At Fishing Bridge itself, camping is allowed only in hard-sided vehicles (trailers, recreational vehicles, station wagons, etc.) because of the danger from bears. It seems likely that the bear deaths are related to the heavy tourism pressure in the area, but whether the conflicts were at fishing sites, the campgrounds, etc., is not clear. That three of the five management controls occurred during the heavy August visitor season tends to support this hypothesis.

TABLE 25. IGBC Data on Grizzly Mortalities Near Fishing Bridge, Yellowstone National Park, Wyoming
(* = judged to be a match with data provided by State of Wyoming.)

Date	Location	Sex	Age	Remarks/Collar Number
8/18/84	Fishing Bridge	M*	7	Mgmt. control, #88
10/16/84	Lake Lodge	M*	2	Mgmt. control
8/17/78	Bridge Bay	M	4	Mgmt. control, #7115
8/11/77	Bridge Bay	M*	10	Mgmt. control
9/19/76	Fishing Bridge	F*	11	Mgmt. control, #7155

(5 additional deaths reported by Wyoming)

Falls River/Conant Creek, Targhee National Forest, Wyoming and Idaho

There appear to have been 10 deaths in the Falls River/Conant Creek area in the last 10 years. Of the 10 deaths reported by the State of Wyoming, four were also reported by the IGBC memo. Knight and Eberhardt classify some of this area as highest density, other portions as high density, and the remainder as common sightings. (See Figure 4, p. 24.) The entire area is Situation I.

Two of the four deaths reported by the IGBC were suspected illegal kills and one was self-defense. The fourth was a suspected accidental drug overdose, although the sex and age of the bear were not known.

This area is home to a large number of nesting trumpeter swans and bald eagles. (See Map 4.) It also provides year-round habitat for both species. There are heavy insect infestations in timber in much of this area, but some of the heavily infested areas have been designated wilderness and therefore cannot be logged. It appears that at least three and perhaps as many as eight of the deaths may have occurred at sites which have already been logged, and one of these sites, if it has not been logged already, is scheduled to be. (When the bear deaths occurred with respect to logging operations is unclear from the data available to the Subcommittees.) There are also two applications for oil and gas drilling permits, one in the lower Falls River area, and the other in the lower Conant Creek area. Each is roughly four miles from the nearest mortality site. There is also an oil and gas lease just three miles south of a grizzly mortality site, straddling the Idaho-Wyoming State line. There is no well at this site.

Orme and Williams[224] reported seven grizzly deaths in this area between 1976 and 1984 that were estimated to be associated with sheep grazing allotments. It is impossible to determine how many match the deaths reported by the IGBC or the State of Wyoming. In Situation I areas, the Targhee National Forest has chosen not to reissue sheep allotments that have been waived, has required special maintenance procedures at sheep camps to reduce the attractiveness of these camps to bears, and has converted one sheep allotment to a cattle allotment -- all measures which should reduce the risk of bear mortalities.[225] The new policy of not reissuing waived permits and the conversion of existing sheep permits to cattle permits, together with poor economic conditions in the sheep industry, will probably reduce grizzly mortalities in this area in the future.

TABLE 26. IGBC Data on Grizzly Mortalities Near Falls River and Conant Creek, Targhee National Forest, Idaho and Wyoming
(* = judged to be a match with data provided by State of Wyoming; ? = information not known or not provided by IGBC memo.)

Date	Location	Sex	Age	Remarks/Collar Number
9/11/82	T48N, R118W, Sec.17	F*	15	Self-defense: hunter
8/20/79	Hominy Peak	M*	12	Suspected illegal kill
7/?/78	Indian Lake, Squirrel Meadows	M*	2	Suspected illegal kill, #30
8/21/76	T48N, R118W, (Sec.28?)	?*	?	Possible drug overdose

(6 additional deaths reported by Wyoming)

Mount Hebgen, Montana, to Henry's Lake, Idaho

There appear to have been 13 deaths in the Mount Hebgen/Henry's Lake area in the last 10 years. Ten deaths were reported by the State of Wyoming, and eleven by the IGBC, with apparent agreement on seven of these deaths. The area is a patchwork of Situation I, II, and III. Most of the deaths occurred in areas ranked highest density, but at least three were in areas of common sightings. (See Figure 4., p. 24.)

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[224]Orme, Mark L. and Robert G. Williams. Coordinating Livestock and Timber Management With Grizzly Bears in Situation I Habitat, Targhee National Forest. In Proceedings -- Grizzly Bear Habitat Symposium. Forest Service Technical Report INT-207. Ogden, UT, U.S. Department of Agriculture, May, 1986. p. 201

[225]Orme and Williams, Coordinating Livestock and Timber Management With Grizzly Bears. p. 195, 201.

Four of the deaths reported by the IGBC were explained as due to management controls, with no further elaboration given, and three more deaths were management accidents, without explanation of whether the agency intended move the bears to another site in the CGYR or whether the intent was to remove the bears from the ecosystem (i.e., "kill" them, with respect to the ecosystem anyway.). Of the remainder, two were due to a car accident, and two were shot. These last two were shot at a private "Res." -- perhaps a resort or residence -- presumably (by inference) to defend human lives or property.[226]

This area is important to bald eagles, trumpeter swans, and some of the young whooping cranes from the Grays Lake National Wildlife Refuge experimental flock. The fishing pressure is among the most intense in the entire CGYR, and focuses mainly on Hebgen Lake and the Madison River in Montana, and Henry's Lake and Henry's Fork of the Snake River in Idaho.

Like Fishing Bridge, recreational development in this area is intense. There are a number of campsites, resorts, second homes, recreation cabins, boat docks, and other facilities in the area. (See Map 7.) The town of West Yellowstone in the center of this area, forms a gateway to Yellowstone National Park and provides many essential services to visitors. The problems for protecting grizzly populations are more complex than at Fishing Bridge, because so much of the land in the area is privately owned. In addition, the proposed Ski Yellowstone project lies in this area and one mortality (the 1978 car accident) lies inside the boundaries of the development. This same ski area has already been leased for possible oil and gas development.

There are widespread insect infestations of timber in the southern half of the area. Again, it appears that the Targhee and the Gallatin National Forests have plans to log on or near the sites of as many as eight of the 13 deaths in this area. Three of the sale planning areas lie directly between the Situation I habitat in Yellowstone National Park and the disjunct island of Situation I habitat less than 10 miles to the West. Parts of the proposed sale area are classified as heavy grizzly use by Knight and Eberhardt. Logging (or other human intrusion) in the area could effectively isolate this island of suitable habitat from the mainland of Situation I habitat. Finally, the increased human presence, if it occurs at times or seasons when bears are active, will expose bears to greater risks of fatal confrontations. Depending on the silvicultural system used, habitat fragmentation could be temporary. However, substantial clearings and sustained human traffic could permanently eliminate grizzlies from this habitat.

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[226]If these two are counted as self defense or property protection, then only one death (rather than three) reported by the IGBC due to self defense/property protection is unaccounted for in the site specific data.

Geothermal leases cover the southern portion of this area, including the site of two 1977 shooting deaths. There are also oil and gas leases in much of the Henry's Lake/Mount Hebgen mortality cluster, including the sites of eight grizzly deaths; the site of a ninth is nearby. These oil and gas leases are nearly all in the northern portion of the mortality cluster, on the Gallatin National Forest, with roughly a third of the acreage in Situation I habitat and the rest in Situation II. Most of the leased area is ranked as high or highest density use by Knight and Eberhardt. While there are currently no producing wells in the area, energy development, in combination with the proposed timber sales could require the bears to

TABLE 27. IGBC Data on Grizzly Mortalities Near Mount Hebgen, Montana, and Henry's Lake, Idaho
(* = judged to be a match with data provided by State of Wyoming; ? = information not known or not provided by IGBC memo.)

Date	Location	Sex	Age	Remarks/Collar Number
8/24/85	West Yellowstone	M	12	Mgmt. control, #20
9/14/84	West Yellowstone	M*	1	Mgmt. accident
10/3/84	Jesse Creek, Henry's Lake Flat	F*	13	Mgmt. accident, #38
8/21/83	T13S, R5E, Sec.34	F*	6	Mgmt. control
8/24/83	T13S, R5E, Sec.34	F*	Cub	Mgmt. accident
6/26/83	Rainbow Pt. Camp T12S, R4E, Sec.24	M	12	Mgmt. control
11/8/80	T12S, R5E, Sec.10	M*	4	Car accident
7/7/78	Hebgen Lake T12S, R4E, Sec.11	F	5	Car accident
?/?/77	Horse Butte T12S, R4E, Sec.20	M	1	Mgmt. Control
9/15/77	Island Park	F*	5	Shot at private "Res." (No data on whether this is illegal, self-defense, mgmt. control, or other.)
9/15/77	Island Park	M*	Cub	Shot at private "Res." (No data on whether this is illegal, self-defense, mgmt. control, or other.)

(3 additional deaths reported by Wyoming)

run a gauntlet of access roads and human presence between the mainland of Situation I habitat and the island of Situation I habitat to the west. Again, road design, access restrictions, future use, and the timing of human presence will determine the isolation of this island of bear habitat.

The Hebgen/Henry's Lake complex is an area of major second home, resort, and tourism development. The high proportion of management controls (whether intentionally or only accidentally fatal) and the fact that the other three deaths were all related to developed facilities, suggest that development pressure is a major source of mortality for the deaths considered in this cluster. The fact that eight of the eleven bear deaths occurred between August and October (during and after tourist season) suggests that recreational development should be watched closely for its effects on risks to bears. Other activities in the area -- Ski Yellowstone, the proposed timber sales, and possible energy development -- will probably increase the future risk of excess grizzly mortalities.

MANAGEMENT IMPLICATIONS

Unlike the damage to bald eagles from DDT, the fate of the grizzly bear in the CGYR does not hinge on one great over-riding threat. There are many causes, but patterns among the various deaths can be used as a guide to preventing future deaths.

Grizzly Mortality Data

The inconsistencies of the various sources concerning grizzly mortalities present a serious problem both for estimating the population of bears at any given time and for managers wishing to use the information in management decisions. Additional data on each grizzly mortality would improve estimates and allow for better management decisions. These additional data include:

1. Statistics on each dead bear: sex, age, approximate weight, date of death (as accurately as possible), and collar or tag number, if any; carcasses in which decomposition has proceeded too far to yield this information should be reported as such;

2. The discovery date and location of each death (using legal descriptions, or some other mapping system of equal or better accuracy);

3. The cause of each death, using forensic techniques if necessary. Probable cause (or causes) could be recorded, but known causes should be distinguished from estimates;

4. The bear's actions at the time of death (if possible); this may be important for understanding the history and cause of the

death, and should not be subject to opinions on the relevance of the bear's actions.

The reasons for management control actions (including non-fatal actions) should become part of the record of grizzly bear management in the CGYR. Such information is far more important to understanding the cause of the death than is a precise description of the method used to dispatch a bear. Non-fatal control actions which remove a bear from the CGYR (to a zoo or to Canada, for example), as they are equivalent to a mortality, for the ecosystem. Finally, non-fatal control actions where a bear is moved within the CGYR are also important because they indicate problem areas and problem bears, both of which may require additional management attention in the future.

The overriding problem with grizzly mortality data is that no agency or group appears to be responsible for maintaining the records. Discrepancies are thus likely to continue. This lack of basic data seriously hampers efforts to increase grizzly bear populations and to reduce human-bear confrontations. The accuracy and comprehensiveness of grizzly mortality data would be greatly enhanced by designating a lead agency responsible for maintaining records of past and all future bear deaths, and for resolving as many discrepancies among existing records as possible.

Preventing Grizzly Bear Deaths

New human intrusions into an area around a mortality cluster are particularly important, and each Federal agency having management responsibility should evaluate management decisions allowing new entries carefully. Where the existing data show a reasonably clear pattern, as they already seem to around the Thoroughfare Plateau and the Falls Creek/Conant Creek area, special efforts to reduce the cause of the conflicts can reduce grizzly mortalities. In the Falls Creek/Conant Creek area, current policy has already begun to reduce the likely human/bear confrontations over grazing; these efforts could be continued or even accelerated. On the other hand, there have recently been complaints about poor enforcement of regulations protecting hunters and grizzlies from each other at the Thoroughfare Plateau.

The data for Gardiner, Cooke City, and Crandall Creek/Sunlight Creek are too vague to suggest definite action; better data -- including new information on the past deaths -- is needed to identify causes and suggest appropriate control actions. The data on bear deaths around Fishing Bridge are almost useless for making management recommendations. If a pattern emerges when the causes of the management controls are studied, specific steps should be taken to address those problems. In the ongoing debate concerning Fishing Bridge and whether it should be closed, bear mortality data should be part of the debate.

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The current level and location of development plans around the Mount Hebgen/Henry's Lake area almost suggest a de facto effort to eliminate bear use west of Yellowstone National Park. Given the high mortalities in the area, the extent of private lands, and the number of recreation facilities, it is even possible that such a plan should be considered, for protection of both the bears and the people, but the question has not been debated openly. Much closer cooperation among the two National Forests, the two States, and the many private landowners is needed if the area is to continue to be available to grizzlies. If it is to be closed off somehow, this policy should be a matter of public and open debate.

More generally, the existence of mortality clusters illuminates the fundamental contradictions in the Management Situation concept. The contradictions arise from an attempt to maximize both grizzly survival and human economics or convenience. The Situation zones appear to represent at least two kinds of decisions: what kinds of human activity to allow in areas important to grizzly bears, and what to do about problem bears in areas of important human activity. Managers treat the lines between Management Situations as if they represented some real aspect of bear biology; managers at the Gallatin National Forest, for example, indicated that a new decision might be reached on a permit for a major ski development if the site were changed from Situation II to Situation I.[227] However, independent observers classify many of the Situation II areas as sites of unusually high bear use. A thorough reconsideration of the Management Situation concept appears appropriate, in view of the large numbers of bears dying in apparently protected areas, and dispatched by managers in areas where bears are common.

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[227]Gallatin National Forest response to Subcommittees' question 20.

FEDERAL AGENCY COORDINATION AND INFORMATION

Numerous Federal agencies are active in the CGYR, including the Forest Service, the National Park Service, the Fish and Wildlife Service, the Bureau of Land Management, the Bureau of Reclamation, the Army Corps of Engineers, the Geological Survey, the National Oceanic and Atmospheric Administration, and more. Coordination is especially important in such an area, so as to avoid duplicative and contradictory programs. This section describes the major legal requirements for inter-agency coordination, identifies and examines the numerous coordinating groups which have been formed, and discusses the information "systems" of the four major Federal agencies in the CGYR that are used to facilitate management and coordination. There are two major findings.

1. The existing coordinating committees are not comprehensive in either agency membership or approach. There is little likelihood of coordinated management of Federal lands in the Yellowstone ecosystem under the existing structure.

2. The existing information is inadequate to analyze the site-specific impacts of proposed actions or to resolve management conflicts. The Forest Service organizational structure is better designed for providing ecosystem-wide data than the structure of the other Federal agencies.

LEGAL REQUIREMENTS

Several laws require Federal agencies to consult with one another in planning their activities. The National Environmental Policy Act provides for coordination in assessing environmental effects of major Federal actions. The laws guiding multiple-use management planning for the BLM and the Forest Service have more explicit direction on inter-agency cooperation. The Endangered Species Act authorizes the Fish and Wildlife Service to restrict, modify, and even prevent Federal actions which would jeopardize the continued existence of rare species. Finally, the National Historic Preservation Act requires Federal agencies to consult with the Advisory Council on Historic Preservation for cultural and historic sites potentially affected by Federal projects. These four laws provide major direction on inter-agency coordination in Federal land management, although other laws require coordination on specific issues or in specific circumstances.

National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA)[225] requires all Federal agencies to prepare environmental impact statements for proposed "legislation and other major Federal actions significantly affecting the quality of the human environment." In preparing such documents, agencies are required to coordinate with other Federal agencies and with State and local governments. Section 102(2)(C) directs that:

> . . . the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved.

A Federal agency undertaking a project which requires an environmental statement must, therefore, consult with other Federal agencies which have expertise on the possible impacts; for example, the Fish and Wildlife Service is consulted when the Forest Service prepares an environmental statement on proposed oil and gas drilling in a National Forest.

Federal Land Policy and Management Act

The Federal Land Policy and Management Act of 1976 (FLPMA)[226] requires BLM to coordinate with other government agencies (Federal, State, and local) in developing land use plans. Section 202(c)(9) specifically requires the Secretary of the Interior to:

> . . . coordinate the land use inventory, planning, and management activities of or for such lands with the land use planning and management programs of other Federal departments and agencies and of the States and local governments within which such lands are located . . .

In addition, section 202(f) directs that:

> The Secretary shall allow an opportunity for public involvement and by regulation shall establish procedures . . . to give Federal, State, and local governments and the public, adequate notice and opportunity to comment upon

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[225]Act of January 1, 1970. Public Law 91-190, 83 Stat. 852; 42 U.S.C. 4321, et seq.

[226]Act of October 21, 1976. Public Law 94-579, 90 Stat. 2743; 43 U.S.C. 1701, et seq.

> and participate in the formulation of plans and programs relating to the management of the public lands.

Resources Planning Act/National Forest Management Act

The Forest Service is similarly specifically required to coordinate with other government agencies in planning for activities in the National Forests. The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA),[227] provides detailed guidance for National Forest planning. Section 6(a) requires National Forest plans to be coordinated with the planning processes of other government agencies, while 14(a) requires procedures for agency comment on Forest Service standards, decision criteria, and management guidelines. Specifically, section 6(a) directs that:

> . . . the Secretary of Agriculture shall develop . . . management plans for units of the National Forest System, coordinated with the land and resource management planning processes of State and local governments and other Federal agencies.

Section 14(a) requires:

> . . . the Secretary, by regulation, shall establish procedures . . . to give the Federal, State, and local governments and the public adequate notice and an opportunity to comment upon the formulation of standards, criteria, and guidelines applicable to Forest Service programs.

Endangered Species Act

The Endangered Species Act of 1973 (ESA),[228] as amended, generally directs Federal agencies to insure that their actions do not jeopardize the continued existence of rare species. Section 7 identifies the procedures for agencies to follow when an action might threaten a species. Specifically, section 7(a)(4) states:

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[227]Respectively: Act of August 17, 1974; Public Law 93-378, 88 Stat. 476. Act of October 22, 1976; Public Law 94-588, 90 Stat. 2949. Both laws encoded at 16 U.S.C. 1601, et seq.

[228]Act of December 28, 1973. Public Law 93-205, 87 Stat. 884; 16 U.S.C. 1531, et seq.

> Each Federal agency shall confer with the Secretary [of the Interior] on any agency action which is likely to jeopardize the continued existence of any species . . . or result in the destruction or adverse modification of critical habitat proposed to be designated for such species.

The U.S. Fish and Wildlife Service, which is responsible for identifying terrestrial and freshwater species which are threatened or endangered and for designating critical habitats for those species, is the agency which is consulted when a rare species is jeopardized by Federal activities in the CGYR.

National Historic Preservation Act

The National Historic Preservation Act,[229] as amended, requires Federal agencies to consider the effects of their projects on cultural and historic sites on the Federal lands. Section 110 includes several specific requirements:

> (a)(1) The heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency. . . . Each agency shall undertake, consistent with . . . the mission of the agency . . ., any preservation, as may be necessary to carry out this section.
>
> (2) With the advice of the Secretary [of the Interior] and in cooperation with the State historic preservation officer for the State involved, each Federal agency shall establish a program to locate, inventory, and nominate to the Secretary all properties under the agency's ownership or control by the agency, that appear to qualify for inclusion on the National Register . . . .
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> * * * * *
>
> (f) . . . . the head of the responsible Federal agency shall, to the maximum extent feasible, undertake such planning and actions as may be necessary to minimize harm to [a National Historic] landmark, and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

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[229]Act of October 15, 1966. Public Law 89-665, 80 Stat. 915; 16 U.S.C. 470, et seq.

Section 106 of the Act also directs the agencies to consider the effects of their actions on historic sites included in or eligible for the National Register, and to obtain comments from the Advisory Council on Historical Preservation on such actions.

INTER-AGENCY COORDINATION

The several Federal agencies with activities in the CGYR have various coordination mechanisms in place. The most obvious example is the comments provided by the National Parks and the Wildlife Refuges to the various National Forests on the Forest plans being prepared under RPA and NFMA. Since these plans will guide National Forest management on all Forests (including those in the CGYR) for the next decade or more (up to 15 years), the comments and suggestions of other agencies may influence the management of the Yellowstone ecosystem.

On the other hand, Forest planning is highly decentralized, with only general direction provided by the Washington Office staff of the Forest Service. More direction is provided by the Regional Offices, but the CGYR includes National Forests from three Forest Service Regions (the Beaverhead, Gallatin, and Custer in Region 1, the Shoshone in Region 2, and the Bridger-Teton, Caribou, and Targhee in Region 4). While there are informal meetings between neighboring National Forests, there is no provision for formal coordination of Forest plans and activities in adjoining areas. Thus, coordination of Forest Service activities in the CGYR is not organized to assure consistent actions and effects. In addition, some agencies feel that they have had inadequate opportunities for reviewing Forest Service activities; the Advisory Council on Historic Preservation, for example, stated that many activities occur without an adequate opportunity for the Council to comment on the proposed actions.[230]

Finally, there is no analysis of the cumulative effects of activities, such as timber harvesting and oil and gas drilling, on the various Federal lands and resources in the CGYR (such as water quality and wildlife habitats). For example, timber sales in Montana proposed by the Gallatin National Forest south of West Yellowstone may restrict grizzly bears' access to habitat in the Targhee NF west of the proposed sales. Similarly, sheep grazing on BLM and private lands in the watersheds above Red Rock Lakes National Wildlife Refuge has caused "severe siltation" of Red Rock Creek.[231] Only a comprehensive review of activities in the CGYR can assure that the activities in one area do not have undesirable and unintended consequences in another.

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[230]Advisory Council on Historic Preservation response to Subcommittees' questions. p. 8, 9.

[231]U.S. Fish and Wildlife Service response to Subcommittees' question 6. p. 3.

Coordinating Committees

The Federal agencies in the CGYR meet frequently to coordinate their activities. There are numerous formal and informal meetings between agencies; for example, most National Forests meet periodically with staff from the relevant State Fish and Game Departments, the National Park Service, the Fish and Wildlife Service, the BLM, and Ranger Districts on adjoining National Forests.[232] There are also meetings in which the various Federal agencies participate, such as the semi-annual Teton County Intergovernmental Meeting and the annual Wyoming Association of Outfitters and Guides meeting.

In addition to these meetings, there are several groups which have been formed to address special management concerns of lands and resources in and around Yellowstone NP; Table 28 displays the groups identified in the agencies' responses to the Subcommittees' questions. None of the groups include all the agencies in the area, and most were identified by only one or two agencies. The group with the broadest Federal participation is the Greater Yellowstone Coordination Committee; however, this Committee apparently excludes the Caribou National Forest and any BLM offices, and which Fish and Wildlife Service unit(s) participate was not specified. This group is presently developing the Greater Yellowstone Plan Aggregation, to bring together the management plans for Yellowstone and Grand Teton National Parks and for the Beaverhead, Gallatin, Custer, Shoshone, Bridger-Teton, and Targhee National Forests; the Plan Aggregation is expected to be completed in late 1986.[233] In addition, most of the groups address specific animal species or management concerns, without considering the broader implication of those issues.

Table 28 was difficult to aggregate because of inconsistent responses. For example, the Bridger-Teton NF identified the "Jackson Elk Studies Group" as meeting once a year, while the National Elk Refuge and Grand Teton NP identified the "Jackson Hole Cooperative Elk Studies Group" as meeting quarterly; it is difficult to determine if these are distinct groups or different reports of the same group. The Greater Yellowstone Ecosystem Bald Eagle Working Group presents another example of inconsistent reporting: the Bridger-Teton NF reported that the group meets once a year; the Caribou NF and the Montana BLM stated that it meets twice a year; the Idaho BLM reported that the group meets three to four times a year.

The incomplete agency responses to the Subcommittees' questions on coordination in the CGYR is perhaps the most serious problem in interpreting Table 28. Some respondents provided little information on the committees to which they belong. For example, the Custer NF identified numerous general meetings but no specific committees, while

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[232]Forest Service responses to Subcommittees' question 28.

[233]Grand Teton National Park response to Subcommittees' question 12.

TABLE 28. Coordinating Committees in the Yellowstone Area
(x = participant; ? = participation identified by another participant;
n/r = not reported)

	Meeting frequency	Identified Participants: Yellowstone NP	Grand Teton NP	NPS Other/Unspecified	Beaverhead NF	Gallatin NF	Custer NF	Shoshone NF	Bridger-Teton NF	Caribou NF	Targhee NF	USFS Other/Unspecified	Red Rock Lakes NWR	National Elk Refuge	Grays Lake NWR	FWS Other/Unspecified	Idaho BLM	Montana BLM	Wyoming BLM	BLM Other/Unspecified	Idaho Fish & Game	Montana Fish & Wildlife	Wyoming Game & Fish	State F&G Unspecified
Greater Yellowstone Coordinating Committee	2/yr	x	x	?	x	x	?	x	x		x	?				?								
Interagency Grizzly Bear Cmte:																								
-Greater Yellowstone Ecosystem Grizzly Bear Mgmt Subc	2/yr	x	x			x	?	x	x		x		x									x	x	x
-Grizzly Bear Research Subc	n/r												x					x						
-Yellowstone Ecosystem Cumulative Effects Task Force	n/r	x																						
Greater Yellowstone Ecosystem Bald Eagle Working Group	2/yr	x	x		x	x	?	?	x	x	?		x					x	x			x	x	x
Tri-State Bald Eagle Working Group	n/r												x											
Montana Bald Eagle Working Group	n/r												x					x						
Jackson Hole Cooperative Elk Studies Group	4/yr	x	x						x		?				x								x	
Northern Yellowstone Elk Management Working Group	4/yr	x				x																		
Tri-State Trumpeter Swan Committee (or Working Group)	n/r		x			x																		
Trumpeter Swan Subcommittee of the Pacific Flyway Council	n/r												x											
Cooperative Rocky Mountain Trumpeter Swan Project	1/yr	x																						
Tri-State Peregrine Falcon Working Group (Recovery Team)	2/yr	x											x											
Interagency Peregrine Cmte	1/yr												x											
Montana Peregrine Falcon Coordinating Committee	1/yr																		x					
Tri-State Whooping Crane Working Group	n/r									x			x									?	x	x
Northern Rocky Mountain Wolf Recovery Team	n/r	x																	x					
Cooperative Rocky Mountain Canada Goose Project	1/yr	x																						
Greater Yellowstone Ecosystem Cmte on Outfitters & Guides	n/r					x							x											
Interagency Travel Plan Cmte	2/yr												x											
Recreation Action (ReAct) Team	2/yr	x	x										?									?		?
Yellowstone River Turbidity-Sedimentation Committee	2/yr	x																						

the Shoshone NF only reported participating in the Greater Yellowstone Coordinating Committee; however, the Bridger-Teton NF reported that the Custer and Shoshone were both members of the Yellowstone Subcommittee of the Interagency Grizzly Bear Committee and of the Greater Yellowstone Ecosystem Bald Eagle Working Team.[234] The Bridger-Teton NF was the only respondent to identify other participants. Thus, group membership shown in Table 28 might not be comprehensive, with important members not identified.

Species-Oriented Analysis

The general approach to coordinated management adopted by the Federal agencies in the CGYR focuses on measures for individual animal species. Such individualized efforts fit within the Forest Service's "indicator species" approach to assuring species diversity in the National Forests. (See the discussion of Indicator Species under Grizzly Bears in Chapter II: The Greater Yellowstone Ecosystem.) That many of the grizzly bear mortality clusters are also important habitats for other animals, such as fishing grounds for bald eagles or migration routes for elk, tends to support the validity of this approach. However, no one species is a perfect indicator of the needs of another species, even if the two species have similar habitat requirements. Measures to protect a species, or to mitigate the effects of activities on one species, may be insufficient or too late to protect other species.

A more telling problem of the species-oriented approach is that it is likely to reduce the coordinated, comprehensive approach to National Forest management. Protection or mitigation measures for wildlife are likely to be viewed as constraints on activities, because they may well impinge on proposed developments. For example, grizzly use of the north side of Mount Hebgen might force restrictions on, or even the cancellation of, the proposed Ski Yellowstone. Yet the area also includes elk and moose calving grounds and moose winter range. A more comprehensive approach to analyzing impacts, and thus to managing the ecosystem, could serve to emphasize fragile or critical habitats and would likely concentrate more intensive development in areas which are less important to animals and water quality.

The effectiveness of the species-oriented approach is also limited, because more than one committee with Federal participants from the CGYR appear to exist for several of the animal species. There are possibly three groups with overlapping membership and areas (both geographic and subject) for bald eagles, trumpeter swans, and peregrine falcons. While these several committees may address differing aspects of the problems, there could well be unnecessary duplication in their efforts. A comprehensive coordinated approach with subcommittees formed as needed, as is used for grizzly bears, could provide more complete coverage with less potential duplication.

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[234]Forest Service responses to Subcommittees' question 28.

Cumulative Effects Analysis

Coordination among Federal agencies in the CGYR (and elsewhere) is important because the effects of various activities may be inconsequential when each is considered alone, but the effects of all activities on the same or adjacent sites, when taken together, could be significant. The Federal agencies are currently developing a model for assessing the cumulative effects on grizzly bears of human activities on the lands of the various agencies. This model may prove a useful tool for examining such impacts, but the model focuses only on grizzly bears. Grizzlies are an "indicator species" for most of the CGYR National Forests, but as discussed above, they are imperfect indicators of the health of the Yellowstone ecosystem. Thus, while a cumulative effects model for grizzlies is a useful first step, it is not sufficient for evaluating the cumulative effects of human activities on the Yellowstone ecosystem.

The Grizzly Bear Cumulative Effects Model

The Forest Service, Yellowstone NP, and the Interagency Grizzly Bear Study Team are developing a "Cumulative Effects Assessment" intended to assess the effects of human activity on bear habitat, distribution, and mortality; a quantitative model (the Cumulative Effects Model) is being developed to assess these effects.[235] The model contains three submodels, each considering several contributing variables. The model is being designed to clarify choices for managers, and predict the effects on the bear population under various alternative management practices and decisions.

The validity of the Cumulative Effects Model, like any other model, depends substantially on the accuracy of its assumptions. Such a model could prove extremely useful, but as described by Weaver et al.,[236] it appears to perpetuate some of the same false assumptions that have marred past efforts at grizzly management. Indeed, other observers have already suggested the need for stringent peer review of

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[235]Weaver, John, Ron Escano, Tom Puchlerz, and Don Despain. A Cumulative Effects Model for Grizzly Bear Management in the Yellowstone Ecosystem. In Proceedings -- Grizzly Bear Habitat Symposium. Forest Service General Technical Report INT-207. Ogden, UT, U.S. Department of Agriculture, May 1986. p. 234-246.

From the information provided in this document, it is not possible to determine if the Interagency Grizzly Bear Study Team is the same as, subsidiary to, or independent of the Interagency Grizzly Bear Committee.

[236]Weaver et al., A Cumulative Effects Model. p. 234-246.

the model's assumptions.[237] The model includes several assumptions which have contrary evidence in the literature:

1. Assumption: Situation I habitat is high quality habitat while Situation II habitat is lower in quality.[238] However, grizzly use, as shown in Figure 4 (p. 24), does not follow the Situation maps; in fact, some Situation II areas, such as Fishing Bridge, include highest use grizzly areas. Rather, it appears that Situation II defines areas with substantial conflict between bears and humans.

2. Assumption: Habitat type and cover type accurately predict the food and cover value of an area to grizzlies.[239] Reid and Gehman document two examples where habitat quality evaluations suggested that the areas were unimportant to bears, while independent ground surveys showed tracks, scat, feeding sites, day beds and other tangible evidence of use.[240]

3. Assumption: The distribution of mortalities "does not differ throughout the period in a manner that would significantly alter the mortality indices."[241] H. D. Picton et al. reported that mortality risks are sensitive to climatic conditions, with increased likelihood of mortality during dry years.[242] Drought reduces the availability of natural foods, and thus the bears range farther and come into more contact (and conflict) with humans.

There are several additional assumptions for which there is not directly contrary evidence, but which either obscure important facts of bear ecology, or severely limit the usefulness of the model. Such assumptions include:

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[237]Winn, David S. and Kim R. Barber. Cartographic Modeling: A Method of Cumulative Effects Appraisal. In Proceedings -- Grizzly Bear Habitat Symposium. Forest Service General Technical Report INT-207. Ogden, UT, U.S. Department of Agriculture, May 1986. p. 252

[238]Weaver, et al., A Cumulative Effects Model. p. 242.

[239]Weaver, et al., A Cumulative Effects Model. p. 238.

[240]Reid and Gehman, Grizzly Habitat Evaluation. p. 93-97.

[241]Weaver, et al., A Cumulative Effects Model. p.243.

[242]Picton, et al., Climate, Carrying Capacity, and the Yellowstone Grizzly Bear. p. 134.

4. Assumption: The value of a given area of habitat is related to the length of use by the bears.[243] However, bears are probably more food-stressed at certain seasons or in certain years. The assumption ignores the possibility that a habitat might provide food briefly but at a critical time, such as in the early spring before the snows have left, when only a limited variety of foods is available. To some extent, this assumption may be countered by the weight the model gives to the presence of protein-rich foods.

5. Assumption: Where there is little human presence, food availability "considerably outweighs cover and denning habitat in contributions" to habitat quality.[244] The authors cite a paper in press to justify the assumption regarding denning sites, but the assumption about cover is not explained. However, cover can provide not only resting sites, but may itself provide food (e.g., squirrel caches), respite from heat, and opportunities to hide young cubs. In dry years, when some foods are less available, and bears are more prone to wandering, cover may be particularly important.

6. Assumption: Habitat fragmentation -- disjunct areas of high quality/use -- is not significant (habitat fragmentation is ignored in the model). However, grizzly bears avoid areas with human presence; disjunct habitat areas may be unusable if they are separated by areas with human activities which prevent the bears from traversing the intervening ground.

7. Assumption: The Interagency Grizzly Bear Study Team data on bear locations accurately represent grizzly use in the area.[245] This assumption may be true, but there are substantial inconsistencies between IGBC mortality data and mortality data from the Wyoming Game and Fish Department, and these two in turn disagree with several other sources. Relying on a single source for such information may be unnecessarily risky, when other sources are also available.

8. Assumption: Legally killed bears or mortalities associated with research activities can be ignored.[246] This may limit the predictive ability of the model, since a substantial number of mortalities (25 percent of the human-related deaths reported by Wyoming Game and Fish and 46 percent of those reported by the IGBC) would be excluded. Further, the model

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[243]Weaver, et al., A Cumulative Effects Model. p. 237.

[244]Weaver, et al., A Cumulative Effects Model. p. 238.

[245]Weaver, et al., A Cumulative Effects Model. p. 238.

[246]Weaver, et al., A Cumulative Effects Model. p. 243.

could not be applied to Yellowstone NP, since at least 10 of the 14 deaths reported by the IGBC fall into this category.

Despite the problems associated with its numerous assumptions, the Cumulative Effects Model may prove useful in certain limited situations. It should not, however, be perceived as an alternative to examination by competent field biologists of an area proposed for development. On-site evidence, such as scats, tracks, and feeding sites, should overrule a prediction of low risk or low habitat quality by the model. In addition, the model should be "field tested" by comparing predicted results with field observations. The model's main utility is probably in predicting obvious problems and conflicts, but with the weaknesses of the assumptions, an absence of predicted conflict cannot be considered a sign of low risk to grizzly bears.

INFORMATION MANAGEMENT

Commodity Resource Data

One significant problem for inter-agency coordination, in the CGYR and elsewhere, is the inconsistent and incomplete data on the activities which occur on Federal lands. Data on the sale or leasing of commodities, generally from the National Forests or BLM lands, tend to be more comprehensive than for other activities. Still, there are significant reporting difficulties for even the market commodities. For example, BLM is generally responsible for minerals activities in the National Forests, and maintains data on leases, claims, and related activities; however, the Forest Service is responsible for controlling surface access and surface activities, while the Minerals Management Service is responsible for collecting payments (bids, rents, royalties, etc.) from minerals leases. The Forest Service generally has access to BLM data.[247] However, the volume and organization of data on leases and claims in the CGYR (an estimated 300 pages of computer printouts for leasing in Idaho and 50 pages for mining claims in Wyoming[248]) makes understanding the site-specific information on energy and minerals activities in the National Forests a challenge for the 15 Forest Service employees (measured in person-years) who manage all energy and minerals activities in the CGYR National Forests.[249]

Grazing on Federal lands provides another example of inconsistent information reporting. Both Forest Service and BLM generally use Animal Unit Months (AUMs) for grazing leases and permits. However, the Beaverhead, Caribou, and Targhee Forests reported sheep grazing in numbers of animals rather than in AUMs. In addition, the Beaverhead

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[247] Shoshone National Forest response to Subcommittees' question 14

[248] [248] BLM response to Subcommittees' questions. p. 17, 20.

[249] Forest Service responses to Subcommittees' question 2.

and Caribou Forests and all three BLM State Offices did not distinguish permitted use level from actual use.

The attention paid to commodity activities by the Forest Service and BLM tends to limit the focus of these agencies on information on non-commodity resources. For example, there is substantial knowledge about the vegetation on commercial timberland, but there is little information about vegetation on other lands, such as wilderness areas. For the CGYR, vegetation data was provided for the 1.76 million acres of commercial timberland in the National Forests, but this is only 17.5 percent of the 10.07 million acres of National Forest land in the CGYR. Similarly, the non-commodity focus of the National Park Service limits information gathering concerning potential commodity resources in Yellowstone and Grand Teton National Parks; the Park Service maintains little data on timber in these Parks. Thus, for the CGYR as a whole, there is virtually no information on vegetation on 8.31 million acres of National Forests, on the 2.55 million acres of National Park land, or on the other Federal, State, or private lands in the area. However, it is important to know how much area is covered by what species of plants, and how much of the total area is open and how much is timbered, to understand the importance of commercial timberland for the various animals which use timbered habitats, and to analyze the impacts of timber harvesting on the animals of the CGYR.

Non-Commodity Resource Data

The Federal agency data on non-commodity resources, such as recreation, wildlife, and cultural resources, is much less complete and more difficult to compare than the data for the commodity resources. Cultural resources, for example, appear to be identified only when a site is uncovered through project planning or on-the-ground activity. The National Park Service, the Federal agency most clearly charged with providing recreation facilities, maintains comprehensive data only on the number of people entering the Parks and on the number staying overnight. There is no long term program of information collection on the types of recreation (fishing, backpacking, tent camping, etc.), or its extent or location. It is difficult to manage recreation or understand its impacts on wildlife populations and habitats without such knowledge.

The Forest Service has much more recreation data, but there are consistency problems. Some Forests have not maintained their data over time; the Caribou NF, for example, maintained no hunting data for years prior to 1985.[250] In addition, the artificial categories used for aggregating the data limit their usefulness. For example, there is not a category for backpacking; backpacking is included in "walking and hiking" which also includes jogging and sightseeing while traveling. Forest Service data are also not very site-specific, unless the

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[250]Caribou National Forest response to Subcommittees' question 17.

site is developed. Data are generally available for each Ranger District, but the Pinedale District of the Bridger-Teton NF, for example, extends more than 80 miles from northwest to southeast. It is also difficult to obtain information on the activities in the subdistricts of the National Forests. These subdistricts may be separated by a considerable distance from the rest of the Ranger District; the Tobacco Root Subdistrict of the Beaverhead National Forest's Madison District, for example, is 10 miles from the Madison Subdistrict and 15 miles from the Gravelly Subdistrict, and separated from these other subdistricts by river valleys of private, State, and BLM lands.

A very serious information problem is revealed by the inconsistent data available on grizzly bear mortality. As discussed above (see Grizzly Bear Mortalities), the Wyoming Game and Fish Department reported 112 grizzly deaths between 1975 and 1985, including 18 natural deaths and 94 man-caused deaths.[251] The Interagency Grizzly Bear Committee reported only 63 man-caused deaths for the same period, while the Fish and Wildlife Service reported 76 man-caused deaths and 7 natural deaths in the period. In addition, when these data sets were compared, at least 17 of the deaths reported by the IGBC could not be matched with deaths reported by Wyoming, and the FWS-reported deaths through 1982 contained too little information to match deaths with other sources. A further problem is illustrated by a 1984 grizzly death on an island in Yellowstone Lake. The FWS reported the death of a female cub due to malnutrition on Frank Island in June; the IGBC also reported the death of a female cub on Frank Island, but on July 9 and from a possible drug reaction. These could be two reports of the same death, but they could be different cubs with the IGBC and the FWS unaware of the other death.

Agency Organizational Structure

The manner in which the various Federal agencies are organized may contribute to the data problems. The Forest Service is generally organized along functional lines, and thus the timber staff have data on timberlands while the recreation staff have recreation data. The multiple-use direction of the agency tends to support such functional responsibilities. The National Park Service and Fish and Wildlife Service, on the other hand, have more focused objectives. Organizing these agencies by resource is probably inappropriate, but a broader mission for maintaining data on all resources could contribute to the existing knowledge about ecosystems.

Another organizational difference is in research. The Forest Service has a separate branch which conducts research and which funds cooperative research with various universities. The Forest Service conducts research on many aspects of land management, including fire and insects, economics, timber management and harvesting, watershed,

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[251]State of Wyoming response to Subcommittees' questions.

wildlife, recreation, and more. Research by the Park Service is within the purview of each Park Superintendent; there is no independent research organization for the National Park Service. Thus, studies tend to be limited by the tenure of the Superintendents. A separately funded research organization, with explicit direction for research in the National Parks, could improve the information on recreation, vegetation, and animals in the Parks by allowing more comprehensive and longer-term studies.

SUMMARY OF FINDINGS

This report examined the lands and resources in and around Yellowstone National Park. Numerous Federal and some State agencies provided information to the House Interior Subcommittees on Public Lands and on National Parks and Recreation. The report summarized and evaluated that information. These are the findings of the report.

THE YELLOWSTONE ECOSYSTEM

1. With the recent return of peregrine falcons and whooping cranes, the wolf is the only major vertebrate lacking from the ecosystem as it was in 1872, when Yellowstone National Park was established. However, the populations of many animals have been reduced by human activities in the area, and further effects on their populations appear likely.

2. Grizzly bears are an important indicator of the health of the Yellowstone ecosystem, because (a) their heavy use areas correspond with important habitats for many other animals; (b) grizzlies are more sensitive to human disturbance than most other species in the area; and (c) grizzlies often die in human-bear encounters. Therefore, grizzly population trends are likely to be leading indicators of the effects of human activities on the ecosystem.

3. The "Management Situation" zones used for considering grizzly bear requirements is inadequate to assure the continued survival of the Yellowstone grizzlies, because it accurately portrays neither important habitat areas nor areas used by grizzlies.

DEVELOPMENT ACTIVITIES

1. Recreation is the most important economic activity occurring on Federal lands in the Committee's Greater Yellowstone Region (CGYR). Excluding the substantial phosphate mining in the Caribou National Forest, recreation creates nearly two-thirds of the direct jobs supported by the CGYR National Forests.

2. The most significant effects of development activities on the ecosystem result from access. Roads can degrade water quality, and many animal species depend on clean water. In addition, human activities can disturb many animal species, particularly grizzly bears. Despite these effects, road construction and access decisions are determined for each resource specialty, rather than as an inte-

grated issue which is broadly examined for its effects on the ecosystem.

3. The economic values used by the Forest Service for some activities (especially recreation) appear to be unrelated to the economic importance of the activities. Since these values are used in assessing management choices, the resulting comparisons may improperly reflect the importance of the various resources.

4. Data on activities and locations are incomplete and inconsistent, hampering coordinated management efforts for the area. Data are particularly poor for non-commodity resources, but even commodity data is not aggregated in a manner which facilitates a comprehensive analysis. Similarly, the categories used, particularly for recreation, are not especially useful for examining the activities which are important.

5. Many of the commodity resource programs in the CGYR National Forests -- timber harvesting, water developments, grazing, and energy and mineral development -- are of minor importance. The jobs in these industries (except phosphate mining) are few, compared to recreation-related jobs. The payments to counties resulting from these activities are unimportant, because changes in receipt-sharing are fully offset by changes in Payments in Lieu of Taxes.

6. Both location of development activities and timing of human presence are important in evaluating impacts of the activities on the ecosystem. Greater consideration of when activities occur can reduce developmental damages to the ecosystem.

GRIZZLY BEAR MORTALITY CLUSTERS

1. The existing data on grizzly bear mortalities is incomplete and inconsistent, even though such information is important for determining effective management practices.

2. Despite the poor data quality, seven areas with concentrations of grizzly bear deaths -- grizzly bear mortality clusters -- have been identified, and the likely causes can be determined for some of these clusters. Focused management efforts can reduce mortalities in these areas, and could substantially improve the probable survival of the Yellowstone grizzlies.

3. The "Management Situation" concept used for grizzlies is not particularly useful for preventing grizzly bear deaths. Many of the grizzly mortality clusters are outside Situation I areas, which have the highest level of grizzly protection.

FEDERAL AGENCY COORDINATION AND INFORMATION

1. The existing coordinating committees are not comprehensive in either membership or approach, and therefore are inadequate for providing complete, coordinated management of the Yellowstone ecosystem. In addition, there are multiple committees focusing on a single animal species, suggesting duplication and fragmented efforts.

2. Data on the ecosystem and on development activities are inadequate to evaluate management choices. The existing data are incomplete and inconsistent among the Federal agencies in the area; little, if any, information requested by the Subcommittees had already been compiled for the area as a whole, including data on grizzly bears.

3. Existing administrative boundaries and organizations hamper comprehensive, coordinated understanding and management of the ecosystem. Regional boundaries fragment the area, and individual units include disjunct lands, with little regard for the ecology of the area.

4. Only Forest Service research is independent of land managers, whose relatively brief tenure limits the long-term scope of research; thus, the research efforts of other agencies are generally insufficient to provide the understanding needed for comprehensive land and resource management of the Yellowstone ecosystem. Long-term research, from economics to vertebrate biology, is hindered or even prevented by the lack of a separate research branch outside the land management structure.

APPENDIX I: QUESTIONS ASKED OF EACH AGENCY

The Subcommittees on Public Lands and on National Parks and Recreation attempted to question every Federal agency active in the CGYR about their major activities, in land management, data collection, and any other responsibility which might affect the ecosystem. In retrospect, it is clear that at least one significant agency was omitted: the Minerals Management Service in the Department of the Interior. This agency is responsible for the royalty collections for energy and mineral resources for energy and mineral resources on public and acquired lands; on Indian reservations; and on the Outer Continental shelf.

In addition, the three State governments were questioned about their activities of the State fish and wildlife agencies in the area. Replies from both State and Federal agencies were voluminous; most agencies included one or more maps in their replies; and many had a series of attachments to expand on their answers.

Each agency received a preface with its questions which included a map of the area to be covered, and described the reply format which would best suit the Subcommittees' needs. Prefatory remarks given below are those sent to the Forest Service; the remarks are typical though perhaps more detailed than for some agencies with less responsibility for land and resource management in the CGYR. (Prefatory remarks for other agencies will be included under each agency listing only if the preface differed substantially from that sent to the Forest Service.) In addition, Subcommittee staff and CRS analysts met with representatives of the Forest Service and of the Department of the Interior to assure that the intent of the questions was clear and that the information requests were feasible.

SAMPLE PREFACE TO QUESTIONS: FOREST SERVICE

> The following questions refer to lands listed in the following table and indicated on the enclosed map. The data should generally be displayed by Ranger Districts, and preferably separated data for the discontinuous portions of Ranger Districts, as identified. When information does not exist at the Ranger Districts, responses by the Forest Supervisor's Office, the Regional Office, or even the Washington Office may be acceptable, but provide answers from the level closest to the field whenever feasible; identify where the response to a given question was prepared, if not at the Ranger Districts. Also, note the relevant time period covered by the answer if it varies from

the time period requested or if no time period was specified.

Where replies call for maps, the following options are preferred:

(1) USGS maps at 1:250,000, with overlays for each different subject. (The eight maps are Bozeman, Billings, Ashton, Cody, Driggs, Thermopolis, Preston, and Lander; these eight can be taped together to provide a comprehensive picture of the entire area.) This option would be the most convenient for the Committee.

(2) Standard sizes of USGS quadrangles as base maps. (Use whatever quadrangle(s) is(are) just detailed enough to do the job.) Overlays that can be superimposed on the same base map would be much appreciated. Even if option 1 is chosen, other maps of other sizes may be needed for particular questions.

(3) Use Forest Service Recreation Maps. Overlays that can be super-imposed on the same base map would be much appreciated.

National Forests & Ranger Districts of Interest to the Committee:

Beaverhead National Forest:
- Madison Ranger District (Provide data separately for the three discontinuous pieces: east of the Madison River, west of the Madison River, and northwest of Ennis)

Gallatin National Forest:
- Big Timber Ranger District
- Bozeman Ranger District (Provide data separately for the two discontinuous pieces: the Gallatin Mtns, and south of I-90)
- Gardiner Ranger District
- Hebgen Lake Ranger District
- Livingston Ranger District (Provide data separately for the two discontinuous pieces: the Crazy Mountains, and south of the Yellowstone River)

Custer National Forest:
- Beartooth Ranger District (Provide data separately for the two discontinuous pieces: contiguous to the Gallatin N.F., and contiguous to the Crow Indian Reservation)

Shoshone National Forest:
- Clarks Fork Ranger District
- Greybull Ranger District
- Lander Ranger District
- Wapiti Ranger District
- Wind River Ranger District

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Bridger-Teton National Forest:
- Big Piney Ranger District
- Buffalo Ranger District
- Greys River Ranger District
- Jackson Ranger District
- Kemmerer Ranger District
- Pinedale Ranger District

Targhee National Forest:
- Ashton Ranger District
- Island Park Ranger District
- Palisades Ranger District (Provide data separately for the portion of the Caribou N F. administered by the Palisades R.D. of the Targhee N.F.)
- Teton Basin Ranger District

Caribou National Forest:
- Soda Springs Ranger District (Provide data separately for the portion of the Caribou N.F. administered by the Palisades R.D. of the Targhee N.F.)

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QUESTIONS FOR THE FOREST SERVICE

Employment and Local Effects

1. How many direct and indirect jobs, and how much local economic activity, result from the major activities which occur on the National Forests; distinguish jobs and economic activity resulting from (a) timber harvesting, (b) grazing, (c) energy and mineral leasing, exploration, and development (distinguish oil, gas, geothermal, minerals, and mining, if possible), (d) fishing, (e) hunting (distinguish by hunted species, if possible), (f) downhill skiing, and (g) other recreation (distinguish packers and outfitters from other local business which benefit from recreation and tourism).

2. How many Forest Service employees (in FTEs) are associated with each of these activities, and what is the total Forest Service employment (separately for each Ranger District and for each Forest Supervisor's Office)? What proportion of the Forest Service budget is associated with each of these activities? In each Ranger District and each Forest Supervisor's Office, use the attached form to gather job responsibilities and professional experience of all management personnel and resource specialists.

3. Identify the Forest Service payments made to each county by each National Forest in the area annually for the past decade.

4. Identify the location of local sawmills and other timber purchasers. What percentage of their timber supply comes from each Ranger District? What other supply sources provide timber in the area? What is the mill capacity (based on 2 shifts per day and a 5-day week), and what has been the annual production for the past decade? How many employees work in each mill?

Timber Management

5. For the past decade, identify the volume and value of timber sold and of timber cut annually, by timber species. Separate the timber salvage sales and harvests from the standard commercial sales and harvests. Display on maps the commercial timber sale areas from which timber has been sold or cut in the past decade.

6. For the past 3 years, identify annual timber receipts (separate deposits to the National Forest Fund from other deposits), expenditures and cash costs, and other impacts (quantifiable effects on recreation, water quality, wildlife, etc). For expenditures and cash costs, separate by the following items: timber sale preparation & administration, resource support, K-V, other reforestation & timber sale improvement, and purchaser road credits. Provide estimates of average cost allowances in timber sale appraisals, excluding logging and milling costs (that is, such cost allowances as slash disposal, erosion control, snag disposal, temporary roads, and scaling costs). Estimate the percentage of costs necessary to maintain non-industrial timber programs (such as firewood permits, pine cone collection, and Christmas tree sales). Also, identify the annual acreage treated with each herbicide used in the past decade for reforestation or for

intermediate timber stand treatments (including release). What percentage of this has occurred in Situation I and Situation II areas?

7. For all commercial timberlands (lands identified as suited for timber production in the Forest Planning process), identify the total acreage and the acreage in each age class by species. For each commercial timber species, identify (a) the standard rotation age used by the Forest Service, (b) the most common rotation ages used by private landowners in the area, (c) the age when the mean annual increment culminates, and (d) the natural rotation age (when insects, diseases, and/or old age typically kill the majority of the trees).

8. Describe -- in words, maps, and tables -- the extent of insect and disease infestations. Describe the options for controlling these infestations (pesticides, prescribed fire, pre-salvage cutting, etc.). Identify the strengths (including research evidence) and limitations of each option, how much each has been used annually in the past 5 years, and the percentage that has occurred in Situation I and Situation II areas. Describe Forest Service policy on pesticide/herbicide use and the agency's integrated pest management programs. Identify the acreage planned for herbicide or pesticide treatment in the next decade, and how much of the planned acreage is in Situation I and II areas.

9. For timber sales planned for the next decade, identify (a) the planned commercial timber sale area locations (on maps), (b) the anticipated volume and receipts, (c) the expected expenditures and cash costs, and (d) other likely benefits and costs. Identify any currently roadless areas (including those released in wilderness acts) which are included in timber sale plans for the next decade. Identify harvesting restrictions that will be put into sale contracts to minimize human-grizzly bear encounters. Finally, identify planned annual timber sale levels for the next 50 years.

Range Management

10. Identify number of grazing permits, the number of AUMs, the months of use, permit fees, and range condition; separate this information for free use versus paid permits and for cows/horses versus sheep/goats. Identify annual investments in the various types of structural and non-structural range improvements for the past decade; include acreage of pesticide and herbicide applications, for each chemical used. Identify the total fees collected and the FY85 grazing fee per AUM. How did the FY85 Forest Service grazing fee compare with fees for private grazing in the area? How many ranchers use Forest Service grazing permits? What portion of their grazing is under Forest Service permits? How many of these ranchers also use BLM permits or leases?

11. Identify annual livestock losses to grizzly bears, other predators, brucellosis, poisonous plants, and other such agents over the past 5 years. What Forest Service programs exist for predator control, and how much Federal money has been spent annually in the past decade on these programs? Describe (and provide any data on) the

effectiveness of these programs. What is the population of wild horses and burros, and how has it changed in the past decade? How many AUMs of forage do wild horses and burros consume annually, and what is the carrying capacity for these animals?

Watershed Management

12. Identify and locate (on maps) all water project applications, licenses, and permits (excluding FERC projects). Provide any analyses of the benefits and costs of proposed projects. How have possible cumulative impacts (on fishing and on other resources) of multiple projects in a given watershed been analyzed?

13. Identify any existing studies about relationships between surface waters, groundwater recharge zones, groundwater, and the hydrothermal features of Yellowstone National Park. What analyses have been conducted to identify these relationships and the possible impacts of timber harvesting, energy drilling, mining, ski area development, and other activities on water quality and groundwater recharge?

Energy and Mineral Management

14. Identify and locate (on maps) all oil leases, gas leases, and geothermal leases; applications for leasing; applications for exploration and explorations in the past decade (identify those which were successful); and applications for development, developments in the past decade, and any developments which have been abandoned.

[NOTE: provide only the data maintained by the Forest Service; data maintained by the BLM is being provided under a separate cover.]

What standard provisions are included in leases for environmental protection? (Be sure to include restrictions to protect grizzly bears.) What analyses are conducted prior to leasing to determine sensitivity of an area to exploration and drilling? Identify all applications for exploration and/or development which have been denied in the past decade, and the rationale for the denial. Does the Forest Service have the authority to overrule a BLM decision to issue a lease or permit? Identify all such occurrences in the past decade in the area. Identify any legal challenges to lease stipulations (either too restrictive stipulations or a lack of necessary stipulations) in the past decade, and their current status.

15. Identify and locate (on maps) all mining claims and mineral leases, by type of mineral being claimed or leased; any claims or leases which have been abandoned; and any active exploration and/or development.

[NOTE: provide only the data maintained by the Forest Service; data maintained by the BLM is being provided under a separate cover.]

Identify all claims which have been denied in the past decade, and the rationale for the denial. Does the Forest Service have the authority to overrule a BLM decision to issue a lease, permit, or claim? Identify all such occurrences in the past decade in the area. What

standard provisions are included in leases for environmental protection? (Be sure to include restrictions to protect grizzly bears.)

Fish and Wildlife Management

16. Identify the fishing recreation visitor days (RVDs) annually for the past decade. Locate (on maps) the areas of concentrated fishing use. What is the economic value of a fishing RVD used in Forest Planning? How does this compare to expenditures by fishermen? What programs exist to eliminate or minimize the impacts of timber harvesting, energy and mineral exploration and development, road construction, and other activities on fishing? What are the policies and practices used to eradicate undesirable fish and/or rehabilitate lakes for native fish? Describe the extent of Forest Service participation in stocking lakes with native or introduced fish species.

17. Identify hunting RVDs annually for the past decade. What species are hunted, and how much hunting effort is focused on each species? Identify areas with particularly intense hunting pressures. What is the economic value of a hunting RVD (separate for the major categories of hunting) used in Forest Planning? How does this compare to expenditures by hunters? Identify all physical barriers (such as fences, roads, and other developments) which affect wildlife populations, including traditional migration routes for elk or other animals. What programs exist to minimize or eliminate the harmful impacts of timber harvesting, energy and mineral exploration and development, road construction, and other activities on hunting? Identify any poaching problems (including locations if applicable), and steps which have been taken to minimize these problems. What policies or plans are in place to control the possible spread of brucellosis?

18. Locate (on maps) all grizzly bear-human conflicts in the past 5 years. Locate (on the same maps) Situation I, II, and III areas. Identify the rationale for the boundaries between these areas; are these boundaries changed when bears are sighted in areas with previously unknown use? How many grizzlies have been killed in the national forests in the past decade (locate on maps)? Identify the principal causes of known grizzly deaths (such as natural causes, road kills, human self-defense, poaching, livestock protection, etc), and the number attributable to each cause in the past decade. What Forest Service programs exist to protect people from grizzly bears and to protect grizzly bears from people? What analyses have been conducted to examine the cumulative impacts of timber harvesting, energy and mineral exploration and development, recreation, and other activities on grizzly populations?

19. Locate (on maps) bald eagle and trumpeter swan concentration areas in the National Forests. Provide a brief description of the preferred nesting habitat for these species. What Forest Service programs exist to protect these species? What is the extent of Forest Service involvement in peregrine falcon recovery efforts? Describe Forest Service habitat management programs for these and other species. What Forest Service programs exist to protect endangered and

threatened species (both listed and candidate species) in the area? Identify Forest Service management policies and monitoring programs on introduced species (such as eastern brook trout and grayling).

Recreation Management

20. Identify the RVDs annually for the past decade for downhill ski areas on the National Forests. Provide maps of existing and proposed ski developments. What is the economic value of a downhill skiing RVD used in Forest Planning? How does this compare to expenditures by skiers? What are the current economic conditions of the ski areas in the National Forests? What is the status of Ski Yellowstone development permits/applications? If development has begun, how large is the unrecoverable investment (net of any timber values, etc)? Provide any studies of the economic and environmental impacts of Ski Yellowstone. Describe the efforts expended to determine the accuracy of recent reports of grizzly bear activity in the Ski Yellowstone area. Would development be halted or altered if grizzly use was proven?

21. Identify the RVDs annually for the past decade for other significant recreational activities in the area -- including camping and picnicking, backpacking/wilderness use, cross-country skiing, other dispersed winter and summer uses, etc. What percentage of each use is in Situation I and in Situation II areas? Locate (on maps) all developed recreation sites, including any National Forest sites leased for summer homes or cabins. What is the current Forest Service policy regarding such leases? What Forest Service policies and programs exist to eliminate or minimize the detrimental impacts of recreation on wildlife? What is the economic value of these RVDs (separate those which have different values) used in Forest Planning? How does this compare to expenditures by recreationists? How much National Forest recreation is dependent on, or occurs because of, other areas (particularly because of the 2 National Parks)?

Cultural and Historic Resource Management

22. Describe Forest Service policy regarding access by native Americans to traditional religious or ceremonial sites. Have there been conflicts in the past ten years over access to such sites? Describe such conflicts and indicate the location of the area on a map.

23. What are the cultural resources or historic sites in the area? What are the prehistoric sites and, briefly, describe what inventories have been made of the sites. Describe Forest Service policy on historic sites within Wilderness areas.

Support Programs

24. For all existing roads, identify their location (on maps), their mileage by maintenance level, and the annual maintenance costs. (If any road is maintained by an agency other than the Forest Service, give the name of the agency, and outline its responsibilities.) Provide existing information on the annual use of each of these roads, preferably by major activity (timber harvesting, energy & mineral exploration or development, hunting or fishing, other recreation,

etc). Identify use restrictions and their rationale. Describe use policies for roads in Situation I, II, and III areas.

25. For all roads, provide annual data for the past decade on the mileage constructed and re-constructed by type of road (arterial, collector, or local), and the costs of these roads (separate for (a) planning and engineering for purchaser credit roads, (b) planning and engineering for FRP roads, and (c) FRP construction and reconstruction). Identify the primary reason for the construction of re-construction, and distinguish totals for roads built primarily for timber harvesting from roads built for other purposes.

26. Identify (and locate on maps) mileage of planned road construction and re-construction for the next decade, by type of road to be built (arterial, collector, or local). Identify the primary reason for the road construction and reconstruction, and distinguish roads for timber harvesting from roads built for other (or multiple) purposes. Identify (and locate on maps) planned temporary or permanent road closures, and identify the rationale for the planned closures.

27. What is Forest Service policy on wildfire suppression in the area? Identify the acreage burned annually for the past decade.

Coordination

28. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

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JOB RESPONSIBILITIES AND PROFESSIONAL EXPERIENCE

The following information should be identified for each professional or technical employee; please complete a separate form for each employee. Under Responsibilities, District Rangers, Forest Supervisors, and their deputies should identify themselves as "Line Officers". Others should rank their areas of responsibility, with a "1" being the most important area; rankings should be limited to 3 or fewer subjects. Experience should be identified as the number of years working in each of the areas, for any employer, including volunteer work or special projects. Finally, under Education, each person should specify each degree attained, and a specialty or emphasis studied, if there is one.

JOB TITLE: _____

RESPONSIBILITIES	EXPERIENCE	EDUCATION
___ Administrative Mgt.		___ Administrative Mgt.
___ Cultural/Historic	___ Cultural/Historic	B.S./B.A. in _____
___ Economics	___ Economics	_____
___ Energy/Minerals	___ Energy/Minerals	
___ Engineering	___ Engineering	
___ Finance/Personnel	___ Finance/Personnel	M.S./M.A. in _____
___ Fire Protection	___ Fire Protection	_____
___ Fisheries Mgmt.	___ Fisheries Mgmt.	
___ Forest Planning	___ Forest Planning	
___ Law Enforcement	___ Law Enforcement	Ph.D. in _____
___ Line Officer	___ Line Officer	_____
___ Policy/Mgt. Anal.	___ Policy/Mgt. Anal.	
___ Pest Mgmt.	___ Pest Mgmt.	
___ Range Mgmt.	___ Range Mgmt.	
___ Recreation Mgmt.	___ Recreation Mgmt.	
___ Timber Mgmt.	___ Timber Mgmt.	
___ Watershed/Soils	___ Watershed/Soils	
___ Wildlife Mgmt.	___ Wildlife Mgmt.	
___ Other (specify)	___ Other (specify)	
_____	_____	

QUESTIONS FOR ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)

1. Briefly describe the effects of the disease brucellosis and its means of transmission. What policies and plans are in place to control the possible spread of the disease? Describe the effects of recent court actions on any plans for thinning herd of elk or buffalo as a means of controlling the disease. Have there been any documented cases of brucellosis transmission from wild to domestic animals in the area. (See enclosed map.)

2. Does the agency engage in any other activities inside the area indicated? Very briefly, describe any other activities of the agency within the area indicated on the Committee's map.

QUESTIONS FOR NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND NATIONAL MARINE FISHERIES SERVICE (NOAA/NMFS)

Very briefly, describe any activities of the agency within the area indicated on the Committee's map. Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments.

QUESTIONS FOR THE ARMY CORPS OF ENGINEERS

Very briefly, describe any activities of the agency within the area indicated on the Committee's map. Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments.

QUESTIONS FOR THE ENVIRONMENTAL PROTECTION AGENCY

Very briefly, describe any activites of the agency within the area indicated on the Committee's map. Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments. Describe EPA's review of the EIS's for the Forest Service plans in the area, and for the EIS's for the other agencies' activities in the same area. Provide EPA evaluations of those EIS's. (Summaries and recommendations are sufficient.) To what extent have cumulative effects been examined by the agencies?

QUESTIONS FOR THE BONNEVILLE POWER ADMINISTRATION

Very briefly, describe any activities of the agency within the area indicated on the Committee's map. Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments.

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QUESTIONS FOR FEDERAL ENERGY REGULATORY COMMISSION

The following questions refer to areas indicated on the enclosed map.

1. How many low head hydroelectric facilities have received licenses or permits in the area? What studies have been done on the cumulative impacts of these projects? Provide copies of any such studies.

2. Is there a shortage of electricity in the area? Will there be in the foreseeable future? To whom would any power generated be sold? What is the current price of electricity (per kilowatt-hour) in the tri-state area?

3. What are your activities in this area for other energy resources, including other hydroelectric projects?

4. Can FERC issue a permit or a license in the area over the objections of the Forest Service? Fish and Wildlife Service? Bureau of Land Management? National Park Service? Bureau of Indian Affairs? Tribal governments? The State? The county? Distinguish between objections raised by an agency over projects proposed for land owned by the agency and projects located on other land that would merely affect the agency's own land. Give examples of agency objections that have stopped projects on their own or other's land.

5. Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments. Very briefly, describe any activities of the agency within the area indicated on the Committee's map.

QUESTIONS FOR THE ADVISORY COUNCIL ON HISTORIC PRESERVATION

Very briefly, describe any activities of the agency within the area indicated on the Committee's map; please include a listing of any particularly important historic or cultural resources in the area, and include their location on a map. Has the ACHP commented in the past on federal agencies' management of historic and cultural resources in the area? If so, what has been the effect of these comments? Has the agency commented on Forest Service plans for any of the National Forests indicated on the Committee map? If so, please provide copies of these comments.

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QUESTIONS FOR THE U.S. FISH AND WILDLIFE SERVICE

The following questions are for the Fish and Wildlife Service, and refer to the Greys Lake National Wildlife Refuge[252], Red Rock Lakes National Wildlife Refuge, and the National Elk Refuge, unless otherwise indicated. Some questions regarding the general biology of various species (in whatever part of the enclosed map) are also included.

Employment

1. How many direct jobs outside the FWS (if any) result from the major activities which occur on the National Wildlife Refuges; distinguish jobs resulting from (a) grazing and timber harvesting (if any), (b) energy and mineral leasing, exploration, and development (distinguish oil, gas, geothermal, minerals, and mining, if possible), (c) fishing, (d) hunting (distinguish by hunted species, if possible), (e) skiing, and (f) other recreation (distinguish packers and outfitters from other local business which benefit from recreation and tourism).

2. How many FWS personnel (in FTEs) are associated with each of the above activities, and what is the total FWS employment (separately for each Refuge)? For all management personnel or resource specialists at the refuges or who work on species in the area, give their job title (and a phrase identifying their primary duties if the title doesn't convey their responsibilities), grade level, and a brief summary of their professional experience (education and years of experience relevant to their current duties).

Leasing and Mining

3. Identify and locate (on Refuge maps) any oil, gas, and geothermal leases; applications for leasing; applications for exploration and explorations in the past decade (identify which were successful); applications for development, developments in the past decade, and identify any developments which have been abandoned. Give the total acreage of these areas. Identify all applications which have been denied in the past decade, and the rationale for the denial. State any restrictions that have been or will be included in contracts or leases in Situation I, II, or III grizzly bear areas.

4. Identify all Federal receipts (including all funds returned to other governments) and all expenditures (excluding the inter-governmental transfers) associated with oil, gas, and geothermal leasing, exploration, and development in the past decade.

5. Identify and locate (on maps) any mining claims and mineral leases, by type of mineral being claimed or leased; any claims or

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[252]The replies from the Fish and Wildlife Service did not include information from the Grays Lake National Wildlife Refuge except for the responses concerning whooping cranes. The reason for the omission was not explained by the Department of the Interior.

leases which have been abandoned; and any active exploration and/or development. Identify all claims which have been denied in the past decade, and the rationale for the denial. State any restrictions that have been or will be included in contracts or leases in Situation I, II, or III grizzly bear areas.

Hunting and Fishing

6. Identify the fishing recreation visitor days (RVDs) annually for the past decade on the Refuges. Where are the favorite fishing sites? (Label them on maps.) What is the economic value of a fishing RVD? How do FWS estimates of value compare to expenditures by fishermen? How many other recreation RVDs (such as camping) are associated with fishing? Have timber harvesting, energy and mineral exploration and development, and other activities affected fishing? If so, how and where? What actions have been taken to minimize or eliminate possible impacts?

7. Identify hunting RVDs annually for the past decade on the Refuges, and distinguish elk hunting from other hunting RVDs. What other species are hunted, and how much hunting effort is focused on each species? Identify areas with particularly intense hunting pressures. What is the economic value of a hunting RVD (separate for the major categories of hunting)? How does this compare to expenditures by hunters? How many other recreation RVDs (such as camping) are associated with hunting? Have timber harvest, energy and mineral exploration and development and other activities affected hunting? If so, how, and where? How do roads affect hunting values and animal populations? Identify all physical barriers (such as fences, roads, and other developments) which affect traditional migration routes for elk or other animals. What actions have been taken to minimize or eliminate potential harmful impacts? Identify any poaching problems (including locations if appropriate), and steps which have been taken to minimize these problems.

8. Identify the RVDs annually for the past decade for other significant recreational activities on the Refuges -- including camping and picnicking, backpacking/wilderness use, skiing, dispersed winter use, dispersed summer use, etc. Identify the location for all developed recreation sites. What other animal populations (including elk, bald eagles, trumpeter swans, listed and candidate endangered and threatened species, and other animals) are known to be affected by recreational activities? What FWS policies and programs exist to eliminate or minimize the detrimental impacts of recreation on wildlife? Identify which roads are most heavily used for recreation access, and what use restrictions exist and the rationale for those restrictions.

Other Wildlife

9. What policies or plans are in place to control the possible spread of brucellosis? Describe the effects of recent court actions on any plans for thinning herds of elk as a means of controlling the disease. Have there been any documented cases of brucellosis transmission from wild to domestic animals in the area?

10. Locate (on maps covering the entire area of enclosed map) all grizzly bear sightings and all human-bear encounters in the past 5 years on all Federal, State, and private lands. Locate (on overlays, if possible) Situation I, II, and III areas. Explain the rationale for the boundaries between the three situation areas; do these boundaries change when bears are sighted in areas with previously unknown use? On overlays, show the boundaries of the "critical habitat" proposed by the FWS under the Endangered Species Act in the mid-1970's. Explain discrepancies (if any) between the critical habitat boundaries and the Situation I, II, and III boundaries. How many grizzlies have been killed in the National Wildlife Refuges in the past decade? (Locate kills on the maps.) Describe the principal causes of known grizzly deaths (such as natural causes, road kills, human self-defense, livestock protection, poaching, etc), and the number attributable to each cause in the past decade. Under what conditions (other than self-defense) can a grizzly bear be shot legally?

11. Locate (on maps) all bald eagle nest sites on private, State, FWS, or other Federal land on the Committee map. What reproductive successes (and failures) have these bald eagles had? How has human activity affected eagle reproduction? Has the FWS made any recommendations to the Forest Service regarding timber management as it affects bald eagles? Describe any bald eagle habitat management programs. Describe the status of other rare or endangered raptors in the area. On a map, indicate the locations of any peregrine falcon nests. What consultation occurs between FWS and other agencies regarding Federal activities around nest sites of any of these raptors?

12. Briefly describe the status of the experimental population of whooping cranes at Greys Lake NWR. What other parts of the area indicated on the Committee map do these birds use? If the population of whoopers in the area continues to expand, how will their use of the area indicated on the map expand? Historically (if such information is available) what areas on the map did whoopers use before their population crashed?

13. Locate (on maps) all trumpeter swan nest sites on private, State, or Federal land in the indicated area. What reproductive successes (and failures) have these swans had? How has human activity affected trumpeter swan reproduction? What FWS programs exist to protect the swans? Describe any trumpeter swan habitat management programs. Has the FWS made any specific recommendations to the Park Service or the Forest Service regarding trumpeter swan management? Provide copies of the recommendations and of the responses from other agencies.

14. Identify any other endangered or threatened species that have been seen in northwestern Wyoming, southwestern Montana, or eastern Idaho. Where does the critical habitat for any of these species extend into the area indicated on the enclosed map? For which have recovery plans been published? What candidate species (including vertebrates, invertebrates, and plants) are found in the area?

15. What are FWS management policies on introduced, non-native species? Describe any regular monitoring to locate introduced species such as eastern brook trout. What are the policies on eradicating undesirable fish with such substances as Rotenone? What techniques are used in rehabilitating lakes for re-introduction of native fish? What are policies on predator control on Refuges? Describe any measurements that may exist on the effectiveness of these policies.

Other Agencies

16. What activities of the Bureau of Reclamation have affected the Refuges in the area? Does the FWS anticipate any potential problems from proposed actions of the BurRec in the area? What authority does the FWS have to alter proposed actions?

17. Has FWS commented formally on any of the seven draft National Forest Plans (for the Beaverhead, Gallatin, Custer, Shoshone, Bridger-Teton, Caribou, and Targhee National Forests) or on the land use plans of the other Federal agencies in the area? If so, provide copies of formal comments. Does FWS plan to comment on any other Forest Plans in the area? If so, which ones? When will these comments be available? In the final plans which have been issued (apparently only for the Targhee National Forest to date), have your comments had a discernable impact on the proposed activities? Has FWS commented formally on activities in the area of the Committee map on the actions of any other Federal agencies? If so, provide a copy of the executive summary, or the actual document if no summary is available.

Roads

18. For all existing roads on the Refuges, identify their location (on maps), their mileage by maintenance level, and the annual maintenance costs. (If any road is maintained by an agency other than the Fish and Wildlife Service, give the name of the agency, and outline its responsibilities.) Specify the principle use of each of these roads for the past 5 years, and describe any proposed changes in their use. Identify use restrictions and their rationale.

19. What is FWS policy on wildfire suppression in the area? Identify the acreage burned annually for the past decade, the losses resulting from fire (identify the method of calculating the losses), and the annual suppression and presuppression costs.

Coordination

20. What are the cultural resources or historic sites in the area? What are the prehistoric sites and, briefly, describe what inventories have been made of the sites. Describe Fish and Wildlife Service policy on historic sites within Refuges.

21. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

CRS-169

QUESTIONS FOR NATIONAL PARK SERVICE

The following questions are for the National Park Service, and refer to both Yellowstone and Grand Teton National Parks. Data concerning the John D. Rockefeller, Jr., Memorial Parkway should also be included as appropriate. Additional questions on more general subjects outside the Parks' boundaries are also included.

Employment and Economic Activity

1. How many direct jobs in the community and how much local economic activity result from the major activities which occur in the National Parks; distinguish jobs resulting from (a) fishing, (b) cross-country skiing, and (c) other recreation (distinguish packers and outfitters from other local business which benefit from recreation and tourism). How many indirect jobs result from each activity? What proportion of the Park budgets are associated with each of these activities?

2. How many Park Service personnel (in FTEs) are associated with each of these activities, and what is the total Park Service employment (separately for each Park)? For all management personnel or resource specialists in each Park and other professionals who are concerned with this general area, give their job title (and a phrase identifying their primary duties if the title doesn't convey their responsibilities), and a brief summary of their professional experience (education and years of experience relevant to their current duties).

3. Identify the RVDs annually for the past decade for all significant recreational activities in the Parks, distinguished by activity; include camping and picnicking, backpacking/wilderness use, cross-country skiing, other dispersed winter use, dispersed summer use, etc. Identify the location of all developed recreation sites. How many sites, and what proportion of each use, are in Situation I and in Situation II (grizzly bear) areas? What programs exist to protect people from grizzly bears and to protect grizzlies from people? What other animal populations (including elk, bald eagles, trumpeter swans, listed and candidate endangered and threatened species, and other animals) are affected by recreational activities? What policies and programs exist to eliminate or minimize the detrimental impacts of recreation on wildlife? What is the economic value of these RVDs in the Parks (separate those which have different values)? What research has been done on recreation values in the Parks, and what are the results of such research? How much of the recreation in the Parks is dependent on, or occurs because of, other recreational opportunities (such as the other Park, the National Forests, the National Wildlife Refuges, etc.)?

Fish and Wildlife

4. How many fishing recreation visitor days (RVDs) were spent in the area annually in the last five years? What are the principle species caught? Where are the favorite fishing sites? What is the economic value of a fishing RVD? How do NPS estimates of value compare to expenditures by fishermen? How many other recreation RVDs (such as camping) are associated with fishing? How might any FERC or other

water projects outside the Parks pose problems for fish or other resources inside the Parks?

5. What are the current estimates on the grizzly population for the entire area indicated on the Committee map? What is the age structure of the population? What, currently, are thought to be the principle causes of death? Indicate, on maps, the sites of man-caused bear deaths over the last five years. What effort is the Park Service making to reduce these causes? Approximately how many bears spend the entire year in the Parks and how many are substantially dependent on resources outside the Parks? If oil, gas, or geothermal leasing are increased around the Parks boundaries, what sort of impacts, if any, would such activity pose to bears? (Quantify if possible.) If NPS predicts that bear deaths would increase, what would be the chief cause of such deaths (e.g., direct interactions with workers, road kills, loss of habitat, or other)? Describe the issues surrounding Fishing Bridge. Will the area be closed, and if so, how will its closure affect grizzly populations and human-bear encounters? What will the impact of this closure be on counties and communities outside the Park?

6. Are any of the herds of elk in YNP essentially independent of resources outside the Park? What are the physical barriers to the migration of elk to or from the Park? Indicate these barriers on a map. Can the herds transmit brucellosis? Is the disease native to this species in this area? Have there been any documented cases of brucellosis transmission from wild to domestic animals in the area? Are any controls being planned to stop transmission of the disease? Describe and analyze recent court actions regarding control of brucellosis.

7. Locate (on maps) trumpeter swan nesting sites in the parks. What have been the principle causes of nesting failures over the last five years? What steps has NPS taken to reduce such problems? Do swans winter in the parks? Where? Are any sites in the area important feeding areas for swans? If so, where and in what season?

8. Locate (on maps) bald eagle nest sites in the parks. Have any of the eagles failed to produce fledglings due to human interference? If so, what are plans or policies for reducing such interference? How dependent is the bald eagle population inside the Parks on recruitment from eagles fledged outside the Parks?

9. What are NPS management policies on introduced, non-native species? Is there regular monitoring to locate introduced species such as eastern brook trout? What are the policies on eradicating undesirable fish with such substances as Rotenone? What techniques are used in rehabilitating lakes for re-introduction of native fish? What are policies, if any, on predator control on Park land? Describe any measures that may exist on the effectiveness of these policies. Identify any poaching problems (including locations if appropriate), and steps taken to minimize these problems.

Visitor Impacts

10. Describe the Parks' current situation regarding intensive visitor use or overuse. In what areas is overuse a serious problem? How are the Parks managing and controlling use to protect vital natural resources where visitor use and resource protection conflict? Are current structural facilities adequate (e.g., sewers, roads, road equipment, etc.)? If not, what are the deficiencies?

11. How is visitor use in the 3 Park system areas projected to increase in the next 20 years? What plans does the agency have for managing the influx (in terms of new roads, sewer facilities, public transportation, and so on)? What steps (e.g., trail permits, limiting entrances, raising fees, closing areas, etc.) will NPS take to reduce the impact of visitors on the Park's natural resources?

Comments on Activities of Other Agencies

12. Has the Park Service commented formally on any of the seven draft National Forest Plans (for the Beaverhead, Gallatin, Custer, Shoshone, Bridger-Teton, Caribou, and Targhee National Forests) or the land use plans of other Federal agencies in the area? Is so, provide copies of formal comments. Does NPS plan to comment on any other Forest Plans in the area? If so, which ones? When will these comments be available? In the final plans which have been issued to date, have your comments had a discernable impact on the proposed activities? If so, how?

13. Has NPS commented on the oil, gas, or geothermal leasing plans of the other Federal or the State agencies? If so, please provide copies of these comments. Based on geological information so far available, which areas of proposed leasing could have the greatest impact the Parks' geothermal resources?

Management Policies

14. Briefly describe what is known and what is suspected about relationships between surface waters, groundwater recharge zones, groundwater, and the hydrothermal features of Yellowstone National Park. Be sure to include water sources both internal and external to the Park. What analyses have been conducted to identify these relationships and the possible impacts of timber harvesting, energy drilling, mining, ski area development, and other activities on water quality and groundwater recharge? Describe how the cumulative effects have been considered.

15. For all existing roads, identify their location (on maps), their mileage by maintenance level, and the annual maintenance costs. (If any road is maintained by an agency other than the Park Service, give the name of the agency, and outline its responsibilities.) Specify the annual use of each of these roads for the past 5 years. Identify use restrictions and their rationale. Identify (and locate on maps) mileage of planned road construction and reconstruction for the next decade and for the next 50 years. Identify the primary reason for the road construction and reconstruction. Identify (and locate on maps)

planned temporary or permanent road closures, and identify the rationale for the planned closures.

16. What is NPS policy on wildfire suppression in the area? Identify the acreage burned annually for the past decade.

17. What are the cultural resources or historic sites in the area? What are the prehistoric sites and, briefly, describe what inventories have been made of the sites. Describe Forest Service policy on historic sites within Wilderness areas.

18. What policies or activities have been carried out as a result of the designation of the area as a World Heritage Site and Biosphere Reserve? In what way do these activities differ from actions that would have been carried out without such designation?

Coordination

19. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

QUESTIONS FOR U.S. GEOLOGICAL SURVEY

1. Indicate, on maps, areas of known or potential oil, gas, and geothermal resources. Also indicate areas of commercial mineral deposits, showing on the map what minerals are thought to be present. Is there leasing interest for any of these energy resources in the area? Explain.

2. In which of these areas is the resource extractable with technologies currently available? How many of the deposits which are technically extractable are also economically profitable under current or reasonably foreseeable market conditions? Would any of the methods required for profitable exploitation require waivers from current law (e.g., substantial surface disturbance inside Wilderness areas)?

3. Identify the USGS study[253], cited previously by Yellowstone National Park Superintendent Barbee, and apparently conducted by the Menlo Park lab, linking the groundwater supply for Yellowstone Park with the Gallatin National Forest. Describe the status of this or any similar studies, identify the researchers, and present any preliminary findings.

4. If any portion of the Overthrust Belt lies within the area outlined, indicate the area of overlap.

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[253]Coates, James. Mining Projects Tap into Controversy at Yellowstone. Chicago Tribune. Aug. 25, 1985. Section 1, p. 4.

5. Very briefly, describe any activities of the agency within the area indicated on the Committee's map.

Coordination

6. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

QUESTIONS FOR BUREAU OF INDIAN AFFAIRS

The following questions refer to the Wind River Indian Reservation, for the portion southwest of U.S. 287, and generally above 7000 feet elevation.

Religious Freedom

1. Is the area of religious significance to the Shoshone or Arapaho tribe? Briefly describe the religious, cultural, and ceremonial use of the area. On a map, indicate generally the areas of major significance. (If this information is considered confidential by the tribe, then provide whatever is available at a suitable level of detail.) Are there areas in adjacent National Forests that are also used for such purposes? If so, indicate these areas on a map, and describe briefly the uses. Are there any disputes over the boundaries of the reservation in this area? Describe any dispute.

2. What are agency policies regarding newly discovered modern or prehistoric burial sites? Describe actions the agency takes when such a site is discovered in, for example, the process of road construction. Describe any consultations that have taken place with the tribal government or religious leadership under the American Indian Religious Freedom Act (42 U.S.C. 1996), the Antiquities Act (16 U.S.C.431-433), or the Archeological Resources Protection Act (16 U.S.C. 470aa, et seq.) regarding burial sites or any other land management issue in this area.

Natural Resources and Subsistence

3. Does the tribe depend on the area for subsistence uses? If so, what are the uses, and what is the current status of the resources? Are there any resource conflicts, such as water rights or hunting, and if so, what are they? Have steps been taken to address these concerns? Does the reservation need assistance in meeting these goals? If so, what sort of assistance?

4. Are some of the animals (e.g., grizzlies, elk, bald eagles, trumpeter swans, buffalo, endangered species, etc.) of special concern in Yellowstone National Park, used in religious, ceremonial, or cultural activities of the tribe? Are these animals still present on the reservation? Are attempts being made to reintroduce them or upgrade their populations on reservation land, and is the tribal government involved in these efforts? Describe any such restoration activities.

5. What are current policies regarding access of non-Indians to tribal land for hiking, fishing, hunting, and other recreation? Are limitations placed on access to sacred areas? Describe the nature of these limitations.

6. What are current plans for road-building and timber harvest in the area? Please indicate such plans, and the location of existing roads, on maps. Might any proposed timber sales affect important tribal resources (religious, ceremonial, cultural, or subsistence)? Do the revenues from these sales exceed the costs to sell the timber for the tribes and/or the Federal Government? How are payments allocated to the tribe? Have any sales in the last 10 years been made over the objections of the tribal government or religious organizations? Briefly describe the nature of the objections and provide copies of tribal objections. Are there differences between the tribe and the BIA regarding preferred management practices? If so, outline the difference.

Miscellaneous

7. Indicate, on maps, who actually owns the land in question: allottees, leaseholders, either tribe alone, both tribes together, non-members of the tribe or other types of ownership. Does the tribe(s) have a natural resource management plan for the area? If so, provide copies. If there is no actual plan, is there a policy or a set of regulations guiding management practices on the land? If so, provide a copy of the policy or the regulations.

8. For all managment personnel and resource specialists that deal with the subjects of these questions, give their job title (and a phrase identifying their primary duties if the title doesn't convey their responsibilities), their grade level, and a brief summary of their professional experience (education and years of experience relevant to their current duties). For the questions indicated above, give the name, title, and brief professional background (education and years of experience) of the individuals working on these subjects.

Coordination

9. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

QUESTIONS FOR BUREAU OF LAND MANAGEMENT

The following questions refer to the public lands indicated on the enclosed map, unless otherwise specified.

Employment

1. How many direct and indirect jobs and how much local economic activity result from the major activities which occur on the public lands; if possible, distinguish jobs and economic activity resulting from (a) timber harvesting (if any), (b) grazing, (c) energy and

mineral leasing, exploration, and development (distinguish oil, gas, geothermal, minerals, and mining, if possible), (d) fishing, (e) hunting (distinguish by hunted species, if possible), (f) downhill skiing, and (g) other recreation (distinguish packers and outfitters from other local business which benefit from recreation and tourism).

2. How many BLM employees (in FTEs) are associated with each of these activities, and what is the total BLM employment in the area? What proportion of the BLM budget is associated with each of these activities? For all managment personnel and resource specialists that deal with this area, give their job title (and a phrase identifying their primary duties if the title doesn't convey their responsibilities), their grade level, and a brief summary of their professional experience (education and years of experience relevant to their current duties).

Payments and Planning

3. Identify all payments made by the BLM or MMS to State and local governments in the area annually for the past decade; be sure to include all receipt-sharing payments as well as Payments in Lieu of Taxes.

4. What is the status of BLM planning for public lands in this area? What proportion of the area has Resource Management Plans, and when were these plans completed? What other plans exist that apply to the public lands in this area? Provide details on the public comments which were received on each of these plans. Identify the BLM administrative units which encompass the lands identified on the enclosed maps, and the boundaries of these administrative units.

Range Management

5. Identify number of grazing leases and permits, the number of AUMs, the months of use, permit fees, and range condition; separate this information for free use versus paid permits and for cows/horses versus sheep/goats. How many cooperative agreements exist between BLM and livestock operators? Identify annual Federal investments in the various types of structural and non-structural range improvements for the past decade; include acreage of pesticide and herbicide applications for range improvement, for each chemical used. Locate (on maps) all existing structural improvements which can benefit or restrict wildlife populations. Identify fees collected (in FY85) and the fee per AUM in 1985. How did these fees compare with fees for private grazing in the area? How many ranchers are dependent on BLM grazing leases or permits? What portion of grazing, for each rancher with a BLM permit or lease, is under these permits or leases? How many of these ranchers also use Forest Service permits?

6. Identify livestock losses to grizzly bears, other predators, brucellosis, poisonous plants, and other such agents. What are BLM policies on predator control? Describe (and provide any data on) the effectiveness of these policies. What is the population of wild horses and burros, and how has the population changed in the past decade? How many AUMs of forage do wild horses and burros consume,

and what is the carrying capacity for these animals? What are BLM management policies on introduced, non-native species (such as eastern brook trout)? What are the policies on eradicating undesirable fish with such substances as Rotenone? What techniques are used in rehabilitating lakes for re-introduction of native fish?

Energy and Mineral Leasing

7. For all Federal land in the area indicated on the enclosed map, identify and locate (on maps) all oil leases, gas leases, and geothermal leases; applications for leasing; applications for exploration and explorations in the past decade (identify which were successful); applications for development, developments in the past decade, and identify any developments which have been abandoned. What standard provisions are included in leases for environmental protection? (Be sure to include provisions to protect grizzlies.) What analyses are conducted prior to leasing to determine sensitivity of an area to exploration and drilling? Identify all applications which have been denied in the past decade, and the rationale for the denial. Does the BLM have the authority to issue a lease or approve an application in national forests, regardless of Forest Service recommendations?

8. For all Federal land in the area indicated on the enclosed map, identify and locate (on maps) all mining claims and mineral leases, by type of mineral being claimed or leased; any claims or leases which have been abandoned; and any active exploration and/or development. Identify all claims which have been denied in the past decade, and the rationale for the denial. Does the BLM have the authority to issue a lease or claim in national forests, regardless of Forest Service recommendations?

Hunting and Fishing

9. For the public lands, identify hunting recreation visitor days (RVDs) annually for the past decade. What species are hunted, and how many RVDs are associated with each species? What is the economic value of a hunting RVD (separate by major category of hunting, if possible)? How does this compare to expenditures by hunters? How many other recreation RVDs (such as camping) are associated with hunting? How much hunting effort occurs in Situation I and II (grizzly bear) areas? Is hunting success different (better or worse) in these areas? What actions are taken to minimize the impacts of timber harvesting, energy and mineral exploration and development, road construction, and other activities? Describe any poaching problems, and steps which have been taken to minimize these problems. What policies or plans are in place to control the possible spread of brucellosis? How many fishing RVDs have there been annually over the past decade?

10. Identify, by timber species, the volume and value of any timber sold and of any timber cut annually, and the acreage cut annually, for the past decade. Provide annual data, for the past decade, on herbicide and pesticide use (for forestry) by chemical.

Coordination

11. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

QUESTIONS FOR BUREAU OF RECLAMATION

1. What is the policy of the agency regarding release of water into the area encompassing the Red Rock Lakes NWR? Will proposals to shift the upstream dam to a peaking power system interfere with current practices? Who would be the recipient of the peaking power? What federal permits are required to make the conversion?

2. Are any other dams in the area proposed for such conversion? In all cases, what studies have been done on the effects of such conversion on natural resources such as native fish or water-dependent birds?

3. Very briefly, describe any other activities of the agency within the area indicated on the Committee map.

Coordination

4. Briefly describe any regular meetings of professional staff with officials of other Federal, State, or local agencies on management issues related to the area indicated on the Committee map. How often or how regularly do these meetings occur?

QUESTIONS FOR THE BUREAU OF MINES

Very briefly, describe any activities of the agency within the area indicated on the Committee's map.

QUESTIONS FOR THE OFFICE OF SURFACE MINING

Very briefly, describe any activities of the agency within the area indicated on the Committee's map.

QUESTIONS FOR STATE FISH AND GAME AGENCIES

The following questions refer to State lands in the areas indicated on the enclosed map, unless otherwise specified. Where replies call for maps, the Committee would appreciate the use of the enclosed map and overlays that can be superimposed on it.

1. For State and private lands, identify the fishing and hunting recreation (RVDs or other appropriate measure) annually for the past few years; distinguish among major types of wildlife recreation, such as elk hunting, antelope hunting, trout fishing, etc. Identify the

most popular areas for these types of wildlife recreation. What is the economic value used by the agency for a fishing or hunting RVD? Identify (and quantify) the known, local impacts of timber harvesting, energy and mineral exploration and development, developed recreation, and other activities on fishing and hunting. What State programs exist to eliminate or minimize the impacts of these activities on fish and wildlife populations?

2. For State and private lands, locate (on maps) all grizzly bear sightings and all human-bear encounters in the past few years. How many grizzlies have been killed in the past decade (locate on maps); what are the principal causes of known grizzly deaths? What State programs exist to protect people from grizzlies and to protect grizzlies from people? What analyses have been conducted to examine the cumulative impacts of timber harvesting, energy and mineral exploration and development, recreation, and other activities on grizzly populations? Does the State agree with the locations of Situation I and Situation II grizzly areas on Federal lands?

3. Locate (on maps) all significant habitat areas for bald eagles, trumpeter swans, and whooping cranes on State and private lands. Describe population trends and any known causes of declines. What State programs exist to protect these species?

4. Does the State have an endangered and threatened species program? For the area identified on the enclosed map, identify the species listed and those under consideration; highlight species which are <u>not</u> included on the Federal list. What State programs exist to protect these species? If the state is making significant efforts on other non-game species in this area, outline these programs briefly.

5. Has the Department commented formally on any of the seven draft National Forest Plans (for the Beaverhead, Gallatin, Custer, Shoshone, Bridger-Teton, Caribou, and Targhee National Forests)? If so, provide copies of formal comments. In the final plans which have been issued (apparently only for the Targhee National Forest to date), have your comments had a discernable impact on the proposed activities? Has the Department commented formally on management or development plans of the other Federal agencies (National Park Service, Fish and Wildlife Service, BLM)? If so, provide copies of the formal comments. Has the Department had an adequate opportunity to comment on these plans? Have the Department's comments had any discernable influence on the plans or the activities or the agencies?

APPENDIX II:
FOREST SERVICE PAYMENTS TO COUNTIES

The Forest Service returns 25 percent of its gross receipts to the counties within which the National Forests are located. This receipt-sharing provision was enacted in 1908 to compensate counties for the tax-exempt status of the National Forests.[254] However, Forest Service deposits to the General Treasury are less than the gross receipts, because the Forest Service is authorized to use timber sale receipts for several special purposes, particularly for road construction and for reforestation and other timber sale area improvements. The counties' shares of Forest Service receipts are calculated before most of these expenditures are deducted from gross receipts, and thus the counties actually receive more than 25 percent of Forest Service deposits to the General Treasury.

The Forest Service payments are distributed according to the proportion of a National Forest's acreage in each county, rather than to the specific counties where the receipts are generated. The gross receipts for each National Forest are allocated among the counties where that Forest is located. For example, Lemhi County, Idaho, contains 4.65 percent of the Targhee National Forest's lands (76,490 acres out of 1,642,755 total acres), so Lemhi County payments would be calculated on 4.65 percent of the Targhee's gross receipts. Lemhi County would also receive payments (calculated in the same manner) from the Challis and Salmon National Forests, since these Forests also have lands in the county.

FOREST SERVICE PAYMENTS TO CGYR COUNTIES

Forest Service payments to counties in the CGYR must be estimated, because several counties have National Forest lands both inside and outside the CGYR. Table 29 shows the estimated National Forest acreage in the CGYR for each county. Estimated Forest Service payments to counties with National Forest land in the CGYR were calculated for each Forest, using the percentage of the county's National Forest land inside the CGYR. For example, approximately 8.9 percent of the Targhee National Forest land in Clark County, Idaho, is in the CGYR; in 1982, the Targhee paid $58,520 to Clark County, and paid about $5,200 to Clark County (8.9 percent of $58,520) for its National Forest land in the CGYR. Table 29 shows that the total

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[254]Act of May 23, 1908. Ch. 192, 35 Stat. 251; 16 U.S.C. 500. While all Federal lands are exempt from local property taxes, this Act applied only to the National Forests.

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TABLE 29. Estimated Forest Service Payments to CGYR Counties
(dollars in thousands; * = estimated)

County (# of NFs)	NF Acreage in CGYR	Forest Service Payments 1982	1983	1984	1985
IDAHO					
Bear Lake (1)	3,650 *	$ .3	$ .4	$ .3	$ .4
Bonneville (2)	482,734	50.5	50.9	60.6	67.9
Caribou (1)	245,150 *	22.0	24.6	20.3	26.3
Clark (1)	15,900 *	5.2	4.8	7.3	7.5
Fremont (1)	525,940	86.5	80.1	121.1	125.1
Madison (1)	41,440	6.8	6.3	9.5	9.9
Teton (1)	88,293	14.5	13.4	20.3	21.0
Idaho Total	1,403,150 *	$185.8	$180.5	$239.4	$258.1
MONTANA					
Beaverhead (1)	34,850 *	$ 2.1	$ 3.3	$ 5.5	$ 3.3
Carbon (2)	256,350 *	20.8	23.6	28.8	23.6
Gallatin (2)	519,850 *	41.7	59.2	52.2	59.2
Madison (2)	514,100 *	33.1	49.8	75.0	49.8
Park (2)	731,600 *	59.2	82.7	74.2	82.7
Stillwater (2)	186,320	15.9	17.2	22.4	17.2
Sweet Grass (2)	252,450 *	20.7	27.0	27.0	27.0
Montana Total	2,495,500 *	$193.5	$262.9	$285.7	$262.9
WYOMING					
Fremont (2)	980,917	$49.6	$59.0	$39.4	$41.9
Hot Springs (1)	54,388	2.7	3.4	1.8	2.0
Lincoln (3)	901,128	65.4	45.5	90.1	57.3
Park (2)	1,695,971	84.8	103.2	64.8	71.8
Sublette (2)	1,169,506	75.0	51.5	104.6	68.2
Teton (3)	1,370,078	104.7	94.9	155.4	170.9
Wyoming Total	6,171,988	$382.2	$357.5	$456.2	$412.1
CGYR Total	10,070,600 *	$761.5	$810.9	$981.3	$933.1

Forest Service county payments due to the presence of National Forest land in the CGYR averaged more than $870,000 annually from 1982 through 1985, and nearly exceeded $1 million in 1984.

Table 29 provides estimates of Forest Service payments to counties due to National Forest lands in the CGYR. However, the receipts being shared might not have been generated in the CGYR. Under the Forest Service system for sharing receipts, activities in one county can affect payments to other counties. Receipts from timber harvesting in the CGYR on the Targhee NF, for example, will contribute to payments to Lemhi County, which has no land within 50 miles of the CGYR. On the other hand, receipts from timber harvesting in the Lemhi Range, 75 miles from the CGYR, will increase payments to the Idaho counties in the CGYR. Thus, Forest Service payments to CGYR

counties are not directly proportional to Forest Service receipts from activities in the CGYR National Forests.

PILT PAYMENTS TO COUNTIES

Forest Service payments to counties can only be spent on roads and schools in the counties where the National Forests are located, under provisions established by each State. These payments often account for a substantial portion of the county budgets for these purposes. However, budgets cannot depend solely on Forest Service receipt-sharing, because Forest Service payments to counties fluctuate widely from year to year; payments to counties from the Beaverhead National Forest, for example, fell by 61 percent in one year, from $312,663 in 1981 to $119,815 in 1982.

Many counties are protected from the extreme annual fluctuations in Forest Service payments to counties by the Payments in Lieu of Taxes Act (PILT), enacted in 1976. This program for compensating counties for the tax-exempt status of most Federal lands. Under this Act, the BLM generally pays counties $0.75 per acre for most types of Federal land (including National Forests). To avoid double compensation for the counties, PILT payments are reduced by Forest Service payments to counties (and by other Federal revenue-sharing programs). Changes in Forest Service payments are, therefore, exactly offset by changes in PILT payments. However, PILT payments cannot fall below a minimum of $0.10 per acre, and the full offset between Forest Service and PILT payments, therefore, only occurs when Forest Service payments are less than $0.65 per acre (less than the standard $0.75 per acre minus the $0.10 per acre minimum). Figure 11 illustrate Forest Service and PILT payments per acre at various levels of Forest Service gross receipts.

Total Federal payments to counties in the CGYR are not affected by changes in Forest Service payments. Changes in Forest Service payments are fully offset by changes in PILT payments, because Forest Service payments are substantially below $0.65 per acre for all of the CGYR National Forests. The highest county payments from the CGYR National Forests for 1982 through 1985 were slightly less than $0.20 per acre from the Targhee National Forest in 1985. Thus, counties in the CGYR receive, on average, $0.75 per acre for the National Forests (and National Parks, National Wildlife Refuges, and BLM lands) in the county.

The offset between Forest Service and PILT payments does not guarantee a constant level of Federal payments to counties, because of the time lags in determining these payments. Forest Service gross receipts determine county payments for the next year, and PILT payments of the following year are adjusted for Forest Service payments. For example, if Forest Service receipts fall in 1987, Forest Service county payments will be reduced in 1988, and PILT payments will be increased in 1989 to offset the lower Forest Service county payments. Thus, on average, counties will receive $0.75 per

acre from Forest Service and PILT payments. When Forest Service receipts fall, counties receive less than $0.75 per acre; however, when receipts rise, as they have been since 1982, counties receive more than $0.75 per acre.

FIGURE 11. Forest Service and PILT Payments Per Acre to Counties